Man and Environment

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Cover: *Katia-jor* or baited pole, a fishing device used by the Mallah in Allahabad District, Uttar Pradesh.

Editorial

Prehistoric sites and settlements are given a comprehensive review by K.R. Dikshit who delivered the Presidential Address at the annual conference of the Society in Delhi. D.P. Agrawal, in his H.D. Sankalia Memorial Lecture, takes up the theme of the current direction of archaeological research. In highlighting some of the major findings of archaeologists working outside India he argues for more research efforts to be directed to questions of archaeological relevance of the current efforts to establish the connection between the Harappan culture and the Vedic traditions. For the opposing viewpoint one can go to Shivaji Singh's article in this issue. The popularity of the Harappan theme is further attested to by the article by the H.D. Sankalia Young Archaeologist awardee, Abhijit Majumdar, on the Emergence of Early Harappans in Gujarat and P.V. Pathak's interpretation of one of the Harappan seals. Shahida Ansari, the awardee for the Malti Nagar Prize in Ethnoarchaeology relates the present Mallah fishing practices to the archaeological record in the middle Ganga valley.

S.A. Sali's summary of his twenty years' fieldwork in Dhulia gives us his invaluable observations and interpretations. This article was submitted to us by his son, Chetan Sali, after his death and I am sure al readers will be grateful to him for seeing that it got published.

M. Petraglia and M. Knoll provide the readers with a comprehensive account of the Indian Palaeolithic collections in the Smithsonian Institution and also the background information about the acquisition of the items in the collection. Sushama Deo *et al.* Present a note on the coastal dune at Kelshi in which Late Historical cultural material has been found.

S.R. Walimbe *et al.* report on the human skeleton found in one of the Deulga Hills rockshelters, from which very interesting rock art has been reported. This skeleton exhibits extreme gracility. Seema Pawankar and P.K. Thomas provide a guide to distinguishing three similar-sized ruminants, sheep, goat and blackbuck. A number of book reviews complete this issue. We hope that given the diversity of topics covered in the issue, ranging from Palaeolithic to the Historical period and from coastal dunes to bone identification every reader will find some item of his/her special interest.

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Prehistoric Sites and Settlements: A Palaeogeographic Perspective[1]

K.R. Dikshit

Salil Apartments
Sanewadi, Aundh
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Archaeology, primarily defined as a branch of learning concerned with the material remains of the man's past, has, during the last five decades, grown into a science that studies almost everything related to human antiquity. In the contemporary revolution that the discipline is witnessing, there is an ever-increasing application of the methods and techniques of science, particularly for the reconstruction of palaeoenvironment of man. This may be related to the sequence of human evolution, prehistoric migration, culture and settlements of prehistoric man, his artefacts, his belief system, his resource base, and the economic and social organisation of the community in which he lived. Thus, archaeology gets linked with a number of cognate disciplines, including palaeogeography, palaeobotany, palaeozoology, and many others. Besides, providing some basic data, palaeogeography introduces a perspective of its own in explaining the prehistoric organisation of human habitat.

Environmental Determinism: A Guiding Principle with Early Societies

During the historic times, the impact of environment was all too pervasive, and for millennia the optimality of human choice in practically all spheres of activity was determined by environmental considerations. The technological revolution gave humanity a large measure of freedom from environmental control, unsurpassed in the long history of mankind. The deterministic principles, often referred to, as environmental determinism, were relegated to the background with the acquisition of scientific knowledge and tools that opened immense possibility to ignore or even overcome environment constraints.

In contrast to the modern world, prehistoric communities had their own perception of environment and moulded their life in tune with their environment. Their economy, settlements, migration, rituals and social organisation, including the selection and abandonment of occupation sites had to weigh the advantages and risks of environment. It may be emphasised that environmental determinism as a principle was more relevant and carried for greater weight in decision-making with the early societies than the modern ones. In fact, the whole story of human evolution and the successive early societies unfolds the principle of environmental determinism.

Environmental Determinism in Human Evolution

The determinists always considered the possibility of evolution of mankind in the Tropics, which have an unending variety of life forms and nutritional resources, with abundance of water, forests, grasslands, fruits, roots and berries. This was the consideration that guided Eugene Dubois to look for the traces of early humans in Southeast Asia. As we know, primates do not live in temperate latitudes. The palaeoclimate of the temperate region, characterised by severity of ice age, shorter duration of day light, short growing period of fruits, leaves and grasses and frozen top soil in winter, was a limiting factor, confining primates to the tropics where finally one of them evolved into humans.

From the age of the hominoids to the *Homo sapiens*, the long story of human evolution has run full course in the tropics, which, no doubt, shifted with the movement of the continental plates, but the centre of mutation and speciation did not shift much beyond the tropics, more so because the Tethys, the site of the present Alpine-Himalayan zone, was closed at the end of Oligocene around 25 million B.P. An important aspect in the history of human evolution is certainly the habitat typology of the primates in different stages of their evolution.

The transformation from apes to what is known in the history of human evolution as 'Hominids', took place around 14 million years B.P. The climate during the Tertiary period was warm, with warm climate extending much further north than at present. With drying of global climate in the post Tertiary period, forests, in the Himalayas and the Siwaliks began to shrink with a change to savannah. This change required a high level of adaptability from the primates: in the process, the primates in forests and partly in savannah adopted a change in diet supplementing it with seeds and vegetables. It should be noted here that the *Ramapithecus* – the jawbone discovered in 1930, initially thought to represent anthropoids – was recognised as belonging to the family *hominidae* after re-examination of the evidence in 1961.

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[1] Presidential Address, delivered on 01.12.2000, at the XXVIII Annual Conference of the Indian Society for Prehistoric and Quaternary Studies, held at the National Museum, New Delhi on 1-3 December, 2000.

The story of *Ramapithecus* and its status in human evolution is a long tale of the discovery of the fossil upper jaw by G.E. Lewis of Yale University in 1930 in the Siwaliks of what is today Pakistan. He named it *Ramapithecus* and considered it to be a hominid. The idea of accepting *Ramapithecus* as a hominid was opposed and the issue remained unsettled till 1961 when Yale anthropologist Elwyn Simons compared it with another similar fossil jaw found in Kenya, called *Kenyapithecus*, and came to the conclusion that Lewis was indeed right in his interpretation and that *Ramaptihecus* was the direct ancestor of *Australopithecus*. Similar fossils were found elsewhere and even in the Siwaliks in the 1970's by the Yale University team led by David Pilbeam and Ibrahim Shah of Pakistan Geological Survey. The V-shaped mandibles and small canines and incisors of these fossil jaws allowed a hominid status to the *Ramapithecus*. The claim of *Ramapithecus* to be hominid has since been disputed because of the cranial anatomy of *Sivapithecus* not resembling that of the *Australopithecus*, the thickness of the tooth enamel being incidental (Simons 1989). A more comprehensive discussion of the status of *Ramapithecus* as a hominid is given by Sonakia (1992).

It is difficult to imagine that the history of evolution was frozen for millions of years till the *Australopithecus afarensis* or *Australopithecus africanus* or *robustus*, the former in equatorial region in Ethiopia and the latter in South Africa. The *Australopithecines* of South Africa, their remains occurring around 26° S. latitude, in the source region of the Orange river cutting into central plateau required an overland migration of over 6000 km. One is tempted to advance a hypothesis that the earliest members of the *hominidae* family, *Ramapithecus* or even *Kenyapithecus* diffused in a two-pronged migration from their original habitat, one towards west and south and the other towards southeast. The latter is quite likely as the vast stretches of forest, savannah and plateau land lay in South and Southeast Asia. But theories are based on facts and discoveries and not on wild or even educated guesses. Archaeologists and other scientists have not yet unearthed fossil remains that could correspond to *Australopithecines* in any other part of the world, besides Africa. Such a find particularly in India or in East and Southeast Asia could change the entire history of human evolution, invoking a theory of multi-foci evolution. A wide transcontinental spread of *Homo erectus* stretching from Indonesia and China to Hungary and Algeria suggests the existence of its forerunners in the vicinity of these areas, and would pose serious challenge to the theory of transcontinental migration of the *Homo erectus* from Africa, the established centre of human evolution, over half the globe.

The Javanese finds at Modjokerto, dated to 1.9 my. B.P., closely resemble those found in lower level at Olduvai Gorge. These fossils suggest that human populations that were anatomically comparable, existed more than a million years ago on both the east and the west side of the Indian Ocean. But Africa is still the only continent where a known sequence of types connecting Australopithecines with *Homo erectus* has been discovered. The most famous of these is Olduvai Gorge.

The clear stratigraphy of Olduvai Gorge with a sequence of bed I dating back to 2 myr. containing *Homo habilis*, and upper bed II containing early and late *Homo erectus*, the latter dated to 1 myr, was discovered by Louis and Mary Leakey, in the sixties. Richard Leakey discovered, in 1975, at Koobi Fora on the eastern shore of Lake Turkana a 1.5 myr. old skull generally acknowledged to be that of *Homo erectus*. It is startlingly like Peking man (Howell 1980). The most telling comment by Howell who organised the Omo Research Expedition in Ethiopia is as follows: "How *erectus* spread into Asia or, in fact, any other place in the old world is not known. Perhaps *erectus* populations evolved independently in several spots from the *habilis* stock."

Early Human Migrations

Despite the advantage central Africa had because of warm climate and an environment suited to hunter gatherers, there was a continuous stream of migration to Asia and Europe, in similar climatic zones or even temperate latitudes, following climatic fluctuations, though it is difficult to reconcile the fact of migration with the known date of fossils in other parts of the world. The most notable of these is the 'Djetis' beds underlying Trinil deposits at Modjokerto in Java dated 1.9 myr. This appears contemporaneous to the *Homo habilis*, dated to 2 myr. (Leakey, R. 1981).

Pleistocene Climate and Population Diffusion (Table 1)

The Pleistocene epoch corresponding with the early Quaternary, lasting for over two million years, is known for its glacial periods alternating with interglacial periods till the beginning of the Holocene around 8000 B.C. The interglacial periods presented an amelioration of climate and warming that triggered migration beyond the tropics.

Except the Neanderthals, most early migrants moved during the interglacial periods towards north and settled in different habitats, like older river terraces, piedmont zones and natural caves, usually those in limestone terrains. The chart below shows the migration of a few known groups of people to Europe during the Pleistocene.

Table 1: Early Migrant groups

People	Locality habitat characteristic	Probable period of migration
Homo erectus	Mauer-near Heidelberg on Neckar river, the oldest human remains in Europe	First interglacial period 700,000-500,000 B.P.
Homo erectus/ sapiens	Danube terrace at Vertesszollos	350,000 B.P. – late first interglacial
Homo erectus/ sapiens	Steinheim-near Stuttgart, gravel deposit	250,000 B.P. – the second interglacial
Homo erectus/ sapiens	Swanscombe (Kent) – Thames middle gravel, stone tools, fossils	250,000 B.P. – the second interglacial
Homo erectus/ sapiens	Tautavel Arago cave – near Tautavel town, late Acheulian industry	200,000 to 300,000 B.P., second interglacial
Homo sapiens neanderthalensis	Neander valley near Dusseldorf, also in France, Italy, Belgium, Greece, North Africa, parts of Middle East	Wurm glaciation, cave dwellers, use of fire – 70,000 B.P.
Homo sapiens sapiens	Cro-magnon, in Dordogne valley limestone caves, caves near village Les Eyzies	Cave dwellers, paintings – 35,000 B.P.

As can be seen, the first migration to Europe occurred before 300,000 B.P. What is important is that the prehistoric sites offer dates that suggest migrations during the interglacial periods. Thus, the glacial - interglacial period signified, in historic terms, increased activity, migration, development in terms of resource utilisation and perhaps increases in human population. It is estimated that about 300,000 years B.P. the population of the earth was around a million, widely dispersed in different parts of the world. The most massive migration to temperate latitudes seems to have taken place during the second and longest interglacial period, between Mindel and Riss lasting for over 250,000 years, between 450,000 B.P. and 200,000 B.P. This was the period during which a large majority of *Homo erectus* sites were formed in Europe, with the sole exception of Mauer (Heidelberg) where man migrated much earlier in the first interglacial period between 700,000 and 500,000 years B.P.

By the time the Riss glaciation arrived, the early migrants to Europe were getting acclimatised and could not only stand the rigour of the ice-age but also develop tools for hunting large mammals. The Neanderthals occupied the site during the glacial period and appear to have disappeared or dispersed, mingled with or absorbed by other groups, to leave no trace during the Holocene.

Glacial-Interglacial Period and Growth of Prehistoric Industry

Nowhere are the traces of the fluctuations of temperature and sea level better preserved than in the marine and river terraces of Europe. The river terraces of the temperate latitudes unlike those of the tropics are well preserved. The glacial period characterised by falling sea level witnessed channel incision, while a rise during interglacial period led to aggradation of the valley with weathered material which was largely composed of clastic elements produced by frost weathering. These terraces provided suitable avenues for prehistoric sites as they had raw material for making tools, water in the vicinity and opportunity for hunting and fishing.

The Abbevillian and Acheulian traditions of tool making originated on the terraces of the Somme River, the former on the 50 m upper terrace and the latter on the 30 m lower terrace. The Abbevillian, beginning from the first interglacial, and the Acheulian starting from the second interglacial, covered the longest tradition of tool making in Europe. The temperate zone river terraces show a remarkable abundance of gravels, marked as the area is by an absence of chemical weathering, particularly in the source regions. It is the frost action that causes rock shattering and produces large blocks that descend down the river as large gravels. Even the flake tool traditions like the Clactonian, named after Clacton-on-Sea in Essex, England and the Levallois in the suburbs of Paris, occurred during the warm and long second interglacial and are preserved in the deposits of this period. The Middle Palaeolithic tools of the Mousterian tradition occur in the third interglacial period. Even the Upper Palaeolithic, representing one tenth of the total Palaeolithic period, developed during the relatively warm interstadials of the last glacial epoch, i.e. the Würm. A spurt in industry and culture during the interglacial and quiescence during the glacial periods have been a norm in European archaeological stratigraphy. About four decades ago Emiliani (1958) produced a temperature curve for the last 300,000 years based on the ratio of oxygen isotopes (^{16}O /^{18}O), and tried to relate it to the phases of human evolution. This fitted admirably with the sea level fluctuation curve of Fairbridge (1960). But both the curves, despite their general validity don't conform to the current situation as the dates of migration and settlement of early humans in Europe are substantially revised.

The Neolithic cultures based on stock breeding and agriculture had to wait till the advent of the Holocene around 8000 B.C.

Palaeogeography and the Spread of Prehistoric People in India

The problem of dating the earliest culture in India has not yet reached finality for two reasons: Firstly, the discovery of ever increasing Palaeoltithic sites in different parts of the country, a fact that will always impart only a temporary validity to the earliest known date of any site, and secondly but not less importantly, is the fact that some of the recent finds that pushed back the time of the known early sites in India are bogged down in controversy, either because of procedural deficiency in dating technique or suspected emplacement of tools in the alluvial, colluvial or delluvial sequences. Yet, during the preceding half a century, the archaeologists have been able to establish that man appeared in India almost at the same time as in Europe and China.

There are many claims made by Indian researchers about the antiquity of man's arrival in India, often based on the Lower Palaeolithic tools. These range from well-dated tools of a few hundred thousand years to hypothetical speculation of a couple of million years. A very good summary of the Stone Age is found in Misra 1989. A comparative study of dates also appears in Possehl and Rissman 1992. The earliest Palaeolithic dates provided by these authors relate to Baghor II in the Son valley (103,800 ± 19,800 B.P.) based on the interdisciplinary work of Sharma and Clark (1983). Surprisingly, Lower Palaeolithic Didwana dated to 390,000 B.P. does not find a mention in Possehl and Rissman chronology. The ages of the Acheulian sites were summarised by Mishra (1992).

The most controversial date of all the Acheulian sites is that of Bori on the Kukdi river in Pune district, Maharashtra (Kale *et al.* 1986). The tephra is dated differently by the researches of different schools. The initial date of 1.4 my. given by Korisettèr *et al.* (1989) is revised . Yet while Rajaguru and Mishra insist on a date of 500,000 years B.P. as the age of tephra, the same tephra is dated to 75,000 years B.P. by Shane and his colleagues (Mishra 1992; Mishra and Rajguru 1994; Mishra *et al.* 1995; Shane *et al.* 1995; Mishra *et al.* 1996; Shane *et al.* 1996). In many instances T230/U234 dates end with 350,000 years B.P., a situation that suggests a higher date. Some of the dates that suggest the antiquity of Acheulian sites in India are given in Table 2.

There seems to be convergence towards the Acheulian culture in India dating back to 350,000 B.P. The controversial date of Kukdi tephra and the 2 my old artefact of Riwat have to wait for wider acceptability and concurrence of views.

Geographical Setting and the Spread of Early Man in India

For human occupancy, the geographical setting can be resolved into regional setting for the migration of people in general and the conditions for locating a cultural site.

Regional setting would be constituted by features that have a relative homogeneity over a wider area, like lithological conditions, climate, terrain conditions, drainage characteristics and vegetal cover. A relative homogeneity of all these aspects may produce a physical region. Early man in India certainly exercised his options depending on his appreciation of a region and the potential it promised. The situation then was very different as it relates to the pre-agricultural phase of human culture when hunting and gathering and possibly fishing were the main means of subsistence and the community life consisted of very small groups.

In the selection of an occupation early man took into account factors that could offer protection from hostile elements, facilitate subsistence and be relatively immune from natural hazards. A synoptic view of the Lower Palaeolithic sites shows clustering in certain areas, sparse distribution in some, and a conspicuous absence in others (Fig. 1). What appears clear is that the alluvial plains like those of the Ganga, Brahmaputra, lower Godavari and lower Kaveri were avoided by early settlers, while there appears to be a clustering of sites in northwest Pakistan, Gujarat, western Maharashtra and the upper Krishna, Narmada and Son valleys. The distribution may be only partly explained by the researchers' preference for archaeological work in certain regions. What appears more significant is the geographical control of the distribution of Lower Palaeolithic.

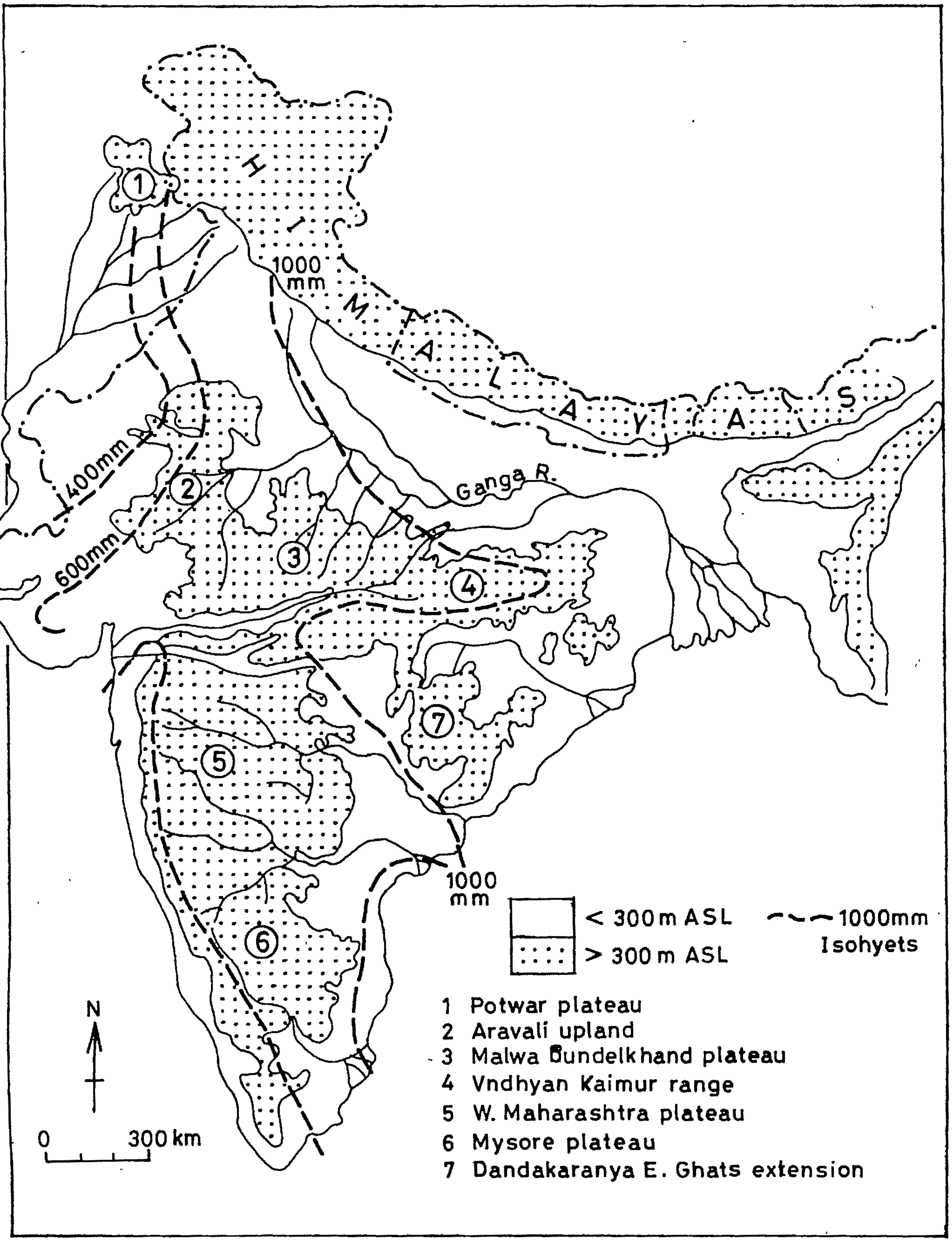

Fig. 1: Regions of stone age sites in India

Table 2: Dates of Acheulian sites in India

Locality	**Site character**	**Age**	**Dating method and Dating by**
Nevasa (Maharashtra)	Acheulian artefacts in gravel deposits	350,000 B.P. (?)	T^{230}/U^{234} Atkinson *et al.* 1990
Didwana (Rajasthan)	Lower Palaeolithic artefacts in sand dune section	>390,000 B.P. (?)	T^{230}/U^{234} Raghavan *et al.* 1989
Umrethi (Gujarat)	Miliolite	190,000 ± 290,000 ± 22,000	Baskaran *et al.* 1986
Yedurwadi (Karnataka)	Calcrete root casts, Acheulian artefacts in gravel	350,000 (?)	Atkinson *et al.* 1990
Sadab (Karnataka)	*Elephas* molar	290,000 B.P.	Szabo *et al.* (1990) Paddayya (1982)
Teggi Kalli (Karnataka)	*Bos* molar	287,000 B.P.	Szabo *et al.* (1990) Paddayya (1982)
Bori (Maharashtra)	Tephra in gravel deposit	75,000 B.P. 5000,000 B.P. 2 my (?)	Shane *et al.* 1995, 1996
Riwat (Pakistan)	Handaxe alluvial section in synclinal valley	>2 my B.P.	Dennell *et al.* (1988)
Hathnora (Madhya Pradesh)	Narmada gravels	>500,000 y B.P. (?)	Faunal assemblage Sonakia 1992
Baghor II (Madhya Pradesh)	Son valley	103,800 ± 19,800 B.P.	Thermoluminescence Sharma and Clark (1983)

Early man, supposedly a migrant from Africa, following the land route was acclimatised to a relatively moderate climate. The climate of the Middle East was not very different about 500,000 B.P. from what it is today. Secondly, he had very primitive stone tools at his disposal that he used for hunting and related chores. This compelled him to be confined to rocky terrain that could offer good tool making material, showing his preference for stony plateaus that were partly covered with forests, offering game he could depend on for hunting. The alluvial plains of the Ganga, having a sedimentary deposit of several thousand metres, lying above a hundred metres above sea level and covered with primeval forests, and at the same time devoid of suitable rocks for tool making, were judiciously avoided by the early man. This is supported by the fact that the lower Indus valley was also shunned by the early Palaeolithic man. The upper Indus valley, particularly the Potwar plateau, lying between Indus and the Jhelum has a variable height of 300 to 600 m, and is unlike the 'Tarai' of U. P. Though a dissected plateau with a rainfall ranging between 400-500 mm, it provided adequate suitable ground for the prehistoric man.

A moderately low-altitude plateau, rocky terrain dissected by streams, sparse forests, low rainfall around 500 mm, away from the steamy forest climate of low altitude plains in the tropics with pouring rains, sum up the optimal habitat conditions. Added to this is the fact that the very early man occupied cave shelters which are available only in the rocky terrain characterised by limestones, laterites, argillaceous sandstones and in basaltic scarps and occasionally granitoid terrain. Most Acheulian sites are close to some stream, as in the areas of relatively low or moderate rainfall, a stream was a perennial source of water. A scarp face or an overhang was an ideal location to offer protection from the rear. A number of rivers like the Son, Narmada, Chambal, upper Godavari, Krishna and Kaveri or even the Central Indian rivers moving north, over a fall zone, to join the Yamuna, Ganga or their tributaries, made ideal sites for early man's habitation.

The Middlle Palaeolithic sites are usually a continuation of the Lower Palaeolithic with improved tools. But when it comes to Mesolithic sites, these suggest a movement further south, reaching almost the tip of the peninsula but there is a complete absence of such sites on Potwar plateau. By the time the culture reached the stage of Mesolithic, blade tool technology had developed and the early man even started domestication of animals, or even camping in open sites on the outer edges of flood plains.

Site Conditions, the most Important Factor in the Location of Prehistoric People

Suitability of site was the single most important factor in the location choice of settlements of the prehistoric people. Sites were not only important for the location and rise of a settlement but also responsible for their decay and destruction. The considerations that guide a location are: (i) Avoidance of environmental hazards, (ii) Proximity to life sustaining resources, (iii) Transport cost and accessibility, (iv) Security (defensibility) and other social factors besides aesthetics (Kohler and Parker 1986). Of these avoidance of hazard, proximity to life support system and defensibility were important to early communities. The considerations for site selection have changed with advance in culture, and could be summarised as follows:

	Groups-Culture	Site
1.	Earliest Hominids	Sedimentary basins in the vicinity of streams, forest fringe and savannah
2.	*Homo erectus*	
	a. Palaeolithic	Caves and higher river terraces, piedmont zone close to rocky terrain, relatively dry areas
	Homo sapiens	
	b. Mesolithic	middle river terraces
	c. Neolithic	River terraces
3.	*Homo sapiens*	
	a. Chalcolithic	riverside in case of agricultural settlements, but less rainy areas with minimal chance of inundation, fertile land, river terraces, divides or even the old flood plains.
	b. Urban settlements based centrality, on other central functions	sea coast, interregional routes, defensive sites

In all situations, river sites were the most favoured sites. The Lower Palaeolithic sites are strung along the rivers, like Sutlej, Narmada, Tapi, Chambal, Betwa and Son, etc. (Misra 1989, Fig. 1). By the time the cultural progress reached the Mesolithic stage, sites were no longer tethered to the rivers, and after the development of farming, search for fertile land assumed importance to support the growing population. Further development of industry, transport and trade gave rise to a new class of towns usually sited on transport foci, coasts, defense locations, and administrative headquarters. These were the early urban centres.

Riverside Settlements

Many of the early Sone Age and Chalcolithic sites are found not far from the riverside. The Bronze Age sites of the Indus valley civilization, Mohenjo-Daro and Harappa, may have been on the riverside during their maturity. Kausambi, a protohistoric site, was on the Yamuna and there was a string of towns on the lost Saraswati. The Chalcolithic settlements of Maharashtra were all on the banks of the Godavari, Pravara, Krishna, Bhima and their tributaries. Nevasa, Daimabad, Inamgaon and many others are all riverside settlements.

Some Riverside Prehistoric Settlements (Table 3)

Early Palaeolithic men lived in very small groups and did not require large sources of water. They could live in rock and cave shelters overlooking the jungles and some source of water. Bhimbetka near Bhopal on a plateau with overhangs and caves and overlooking the scarp-bordered asymmetrical valley, and Adamgarh cave close to Narmada are such Palaeolithic sites which don't suggest the dwelling of a large population that has to seek a large source of water even for drinking.

The Mesolithic and Chalcolithic sites, on the other hand, were thronged by larger communities and their needs for water and of a variety of economic resources, particularly land were much greater. A change in the economy necessitated a change in site and the population began to cluster on the riverside with a relatively rich agricultural resource, the fertile soil.

The beginning of agriculture and domestication of cattle at the beginning of Holocene around 8000 B.C. with climatic amelioration caused a spurt in population growth.

Riverside, an Attractive Site for Settlement but Destructive in the Long Run

The author of this paper has not heard of any town on the riverside that has not suffered the ravages of flood at one time or the other. The recurrent period of such floods may be several hundred years or even a thousand years, but devastating floods are known in historical and prehistoric times. Flood prevention measures and technical advances

Table 3: Some riverside prehistoric settlements

Locality	**Associated River**	**Area of Site**	**Height of site above**	**Present rainfall river plain**
Bhimbetka	Cuesta scarp Betwa-Narmada divide	—	21 m	87.5 cm
Adamgarh	Cave site, on Narmada	—	—	—
Sihawal	Son river	—	—	—
Nevasa	Pravara river	—	—	45 cm
Mohenjo- daro	Indus and Nara	240 acres	21 m	15 cm
Harappa	Ravi loop	160 acres	18 m	37.5 cm
Inamgaon	Ghod river	58 acres	17 m	43 cm
Daimabad	Pravara	—	10 m	60 cm
Kausambi	Yamuna	—	26 m	87.5 cm

in flood management enable the contemporary societies to minimise the damage caused by such floods, survive and readjust their lives. But this was not the case in prehistoric times.

The channel properties of large tropical rivers show some common features in their lower courses like floods, changes in the river course, straightening the meanders leaving cut-offs, and creating river islands following braiding of the channel. These changes led to the destruction of many prehistoric settlements.

Destruction of some Prehistoric Settlements

The cases referred here include Mohenjo-daro, Harappa, Kausambi, Daimabad and Nevasa.

Mohenjo-Daro is located in the plain of Larkana, which was annually inundated till the construction of the Sukkar barrage. In the distributary pattern of Indus delta, Indus and Mihran were constantly changing their courses. It is clear that Mohenjo-Daro suffered not so much because of floods to which the inhabitants were used, but because of the destructive swing of the river, demolishing every thing in its wake. The ancient bricks in Mohenjo-Daro remain 9 m below the ground, and a 9 m rise of flood is not improbable. The hypothesis of the capture of the headwaters of the Yamuna, flowing westward into Hakra as advanced by Thapar (1984, 1993) is not necessary to explain the shift in the course of the Indus river and its distributaries causing in their wake the destruction of the settlement. The flooding must have been repeated over decades to cause demolition of the settlement and shift in the river course. The theory of the change of the river course for the destruction of Mohenjo-Daro is confirmed, among others, by Lambrick (1967) and Flam (1999). The latter has demonstrated the shift in the course of the Indus during successive periods. Isn't Patliputra destroyed because of shift in the course of the river Ganga?

Harappa, lying in Montgomery district of Punjab, is located on a ridge locally called the great Dhaya ridge. The mound of Harappa stands 18 m above the plain. The Ravi flows ten kilometers to the north. The old course of the Ravi is immediately to the north. Vats (1940) finds the evidence of the destruction due to flood in the solid mass of sun-dried bricks at the foot and sides of all the mounds to a considerable height. According to him, laborious work like this could be done only in the face of real dangers from flood. Kalibangan may have perished because of the diversion of headwaters of the Ghaggar river.

Kausambi on the Yamuna with a relative relief of 26 m (the level above the bed of the Yamuna) is on the convex bank of a meander of the Yamuna, representing an undercut slope. From the southern edge of the mound, one can see the stream flowing 26 m below. The settlers must have seen the progressive annual bank erosion of the river and left the site. In the case of Nevasa, the site was shifted a number of times (Sankalia *et al.* 1960) and Daimabad suffered disastrous floods in 1947 and 1956, inundating the ancient mounds (Sali 1986).

A General Theory of the Origin of Settlements

This refers to a community living at a site that could ensure protection against hostile elements and natural hazards, adequate means of sustenance through the use of local resources, and easy access to other areas for acquisition and transfer of raw materials, technology, goods and services. The perception and needs of the groups would vary depending upon the environment of their habitat, technology at their disposal and the priority they have in choosing from different economic resources for their living. The pre-agricultural settlements would take hunting and gathering convenience as a prime consideration whereas the agricultural societies would tend to concentrate on raising food crops. Thus settlements could be viewed according to the period of their origin, their principal source of sustenance, technology and their location and can be grouped as in Table 4.

The Population Growth and Village Settlements

The village or rural settlements as we find them today, emerged in most fertile areas above the inundation level of river. The river terraces became the most favoured location as they promised fertile land with high productivity. At any time, the village expansion in a fertile zone of a specific level of productivity was limited by the capacity to cultivate and supervise a specific area of land around a village. The sudden explosion of population between 10,000 B.C. and 6000 B.C., that is Early Holocene, stimulated efforts to intensify the use of agricultural resources (Table 5).

A sudden increase in population in the last ten thousand years required more land to be cultivated which could not be done from a few villages providing focal points. This resulted in spatial diffusion.

The spatial diffusion of villages was helped by technology to develop surface storage of water and even explore the groundwater potential. The Harappans are known to have mastered the art of well digging. The riverside location could no longer be a binding factor, and repeated migrations and resettling of the excess population produced generations of villages. Thus, three factors, viz. increase in population, development of techniques for exploiting surface and groundwater, and the inability of the early farmers to cultivate a patch larger than the area warranted by easy accessibility were responsible for the diffusion of population in space and creation of more and more villages. After a village grew beyond the support capacity of the immediate agricultural hinterland which could not be more than 6 to 7,500 hectares, granting a distance of five kilometres that the primitive farmers may have liked to travel, to and fro, from their residences. The entire land could not be cultivated because of the physi-

Table 4: Grouping settlements according to the period of their origin

Period	Tools and techniques	Main occupation	Nature of settlement	Site preference
Historic	Pre-industrial settlements	Agriculture, industry, trade and commerce	Permanent villages and towns river and sea side central location	Fertile plains,
Agricultural communities, Early Historic	Use of iron tools, techniques of irrigation	Farming, trade and commerce, administration	Permanent villages and some towns	Fertile plains, source of irrigation water, river and sea side
Neolithic and Chalcolithic	Improved tools and implements, wells	Farming, hunting and fishing	Semi-permanent, permanent and a few central places	Riverside and fertile plains
Mesolithic	Improved stone tools, blades arrowheads	Organised hunting, gathering, some cattle	Temporary, semi-permanent	River terraces, plateaus, relatively dry climates, close to river
Palaeolithic	Crude stone tools	Hunting gathering	Ephemeral temporary semi-permanent	Plateaus, forest edges close to water, cave shelters

Table 5: Population changes during the Holocene

Period	Population of the habitable earth	Density per sq. mile of the habitable earth	People and events
2,000,000 B.P.	125, 000	0.01	Hominid
300, 000 B.P.	1, 000,000	0.03	*Homo erectus*
25, 000 B.P.	3, 340, 000	0.1	Cro-magnon
6, 000 B.C.	86, 500,000	2.6	Agricultural revolution
1750 A.D.	728,000,000	12.7	Industrial age
1950 A.D.	2, 400, 000,000	42.5	Medical Revolution
2000 A.D.	6, 490, 000,000	124	Environmental resources under stress and international migration

ographic constraints and other competing uses. Allowing for 40 percent of the land available for cultivation, it would leave 3000 ha for cultivation. Allowance has to be made for rotation as manuring was not common and fallows were indispensable. Cultivation of a patch every third year would leave only 1000 hectares of land to be cultivated every year. The Garos of Meghalaya produce 1.5 to 2.4 quintals of rice and 0.5 quintals of maize per acre by shifting cultivation, but the farming societies thousands of years ago would have found it difficult to reach productivity of this level. *A priori*, one may take 0.5 to 0.8 quintals, an average around 0.6 quintals per acre i.e. 1.5 quintals per hectare. This would mean about 1500 quintals of food grains, just enough for a community of 400 people. As the population grew, technology also grew and the productivity may have also grown, but it would reach a level, when a section of the population will be forced to migrate to alternate sites, as it would be much above the support capacity of local resources.

The process of diffusion of the village depends on the increase in population outgrowing the local support base. This will continue till the most fertile patches of land are occupied. These villages will have more or less uniform size. The next generation of villages will occupy the left over land that is less productive, offering support to a smaller number of people. The process, by repetition, would produce several generations of villages, each succeeding generation having smaller villages than the previous one. This would create a hierarchy of rural settlements quite distinct from the hierarchy of central places. What is being emphasised is that the hierarchy of settlements was inherent in the successive growth of a generation of villages and does not depend on the acquisition of central functions, as is made out by contemporary researchers of settlements.

The village development had far advanced by the time the Mauryan empire was established. Kautilya recommends a minimum of 100 and a maximum of 500 families in a village, with boundaries extending over one *Krosa* or two *Krosa*, and affording mutual protection (Kangle 1965: 62). Kautilya recommended four kinds of central places, each with a hinterland or a catchment with specific number of villages. These are in a five-fold arrangement, corresponding to the hierarchy of central places.

STHANIYA – in the middle of 800 villages

DRONAMUKHA – in the middle of 400 villages

KARVATIKA – in the middle of 200 villages

SAMGRAHNA – in a group of ten villages

Village – the lowest place in the hierarchy

It is clear that as early as the third century B.C. or even earlier a hierarchy of settlements was recognised. And the hierarchy of settlements suggested by Kautilya far antedates the hierarchy suggested by Walter Christaller (1956), applied to central places, in an universe of villages. Of late, archaeologists have started talking of the Chalcolithic settlements of northwest India as nested in a hierarchy, each settlement having a domain (Possehl 1999) A similar approach is adopted by Makhan Lal (1984) in the study of the prehistoric settlements of the Ganga valley. It may be suggested that instead of applying the central place concept of a nested hierarchy of Christaller, one may consider hierarchy in a rural framework born out of a generation of villages, each subsequent generation having smaller villages than the previous one.

Relevance of a Theory of Settlements to Archaeological Analysis

A theory of settlement could be a very effective introductory guide in understanding the origin and decay of prehistoric settlements. A village is not only a culture complex but also an economic base, which offers opportunity for generation of economic resources and community living. Its origin and decay, both are governed by the security and the sustainability of the economic resources. While the origin of prehistoric settlements is a clear-cut case of an advantageous location, the explanation for decline, destruction, or desertion of the settlements is not infrequently controversial. The decay of a settlement could be very sudden, or it could be very slow and gradual. Sudden and catastrophic events may include earthquake, fire, volcanic eruption, catastrophic floods, major landslides, shifting course of a river, change in hydrologic regime amounting to minimal or no discharge and drought or a change in climate. A drastic change in man-land ratio following growth of population or a complete degradation of land making it unsuitable for cultivation could also force people to migrate to another site.

The decay of settlements in Hakra (Gaggar) valley attributed to the drying up of its channel is stated by many (Thapar 1984, 1993; Mughal 1992). While Mughal is silent on causes of drying up and westerly shift of the river Hakra, Thapar thinks, and perhaps rightly so, that the piracy of the headwaters of Hakra and Yamuna by the Ganga system deprived the Hakra system of its Himalayan waters.

A change in climate is a gradual process and gives enough time to people for adjustment to the emerging situation. A rise of temperature by a few degrees would not force the people to leave the settlement. Unless the hydrology is affected, the desertion of a site is a remote possibility. The annual discharge of a large river system does not depend on the precipitation in a small area but on the magnitude of rainfall in the catchment above a point. There are many allochthonous rivers maintaining steady discharge without much rain in the lower parts of their catchment. Climate change as a cause for desertion has to be viewed with caution.

In contrast, if diffusion of population and splitting of the village is taken as a process in settlement development, desertion of one site in favour of a better one appears more plausible.

Climate Change is Region Specific

There have been many studies outlining the wet and the dry periods during the Holocene and even during recent periods. Starting from Bryson and Swaith (1981), Sukumar *et al.* (1993), Overpeck *et al.* (1990) to Enzel *et al.* (1999) and Deniston *et al.* (2000), these studies depend on the evidence collected in, or relevant to, some specific region of the country. India is a large country and the climate, temperature and precipitation conditions are not uniform all over the country even today. The slender evidences based on qualitative assessment of geomorphic and palaeobotanical findings may be qualitatively valid only in specific areas. Likewise, use of calcrete or speleothems, or salinity gradient of Bay of Bengal may be of very limited value. The monsoon climate where the rainfall and temperature variations are considerable, a very rainy summer monsoon followed by very high temperature before the summer months could produce sedimentary facies analogous to wet and dry climate. This particularly applies to the study of duricrusts.

Prehistory and prehistoric sites carry an unmistakable imprint of environment, particularly the climate and hydrological regime of rivers. That brings in topography that governs the sites ensuring their optimality in terms of security, human comfort and economic base. The decay and the desertion of sites and human migrations follow equally the changing ecological conditions of the areas. This aspect was emphasised by K. W. Butzer (1974). Let us hope we have taken adequate note of his lamentations.

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The Idea of India and its Heritage: The Millennial Challenges[1]

D.P. Agrawal

Ashirvad
Near Pande Lodge
East Pokharkhali
Almora 263 601

I am greatly beholden to the Indian Society for Prehistoric and Quaternary Studies for inviting me to give the Professor Sankalia Memorial Lecture. This gives me an opportunity to pay my humble tribute to that great scholar and also a chance to share some of my thoughts and fears with this learned gathering. At this stage of life I am more seriously concerned about the future of archaeology, both here and abroad.

Now that I am free from routine administrative work and the endless meetings, I get more time to read and think. The market is flooded with exciting books and quite a few of them are in affordable paperbacks. On the other hand, there are things you may not like to read, but the media hype almost forces you to read them too. In fact, it is these two contrasting demands on my time that has provided the ideas for this talk.

This led me to think about the substantive issues in Indian archaeology. Are they getting proper attention backed by requisite effort? Or are we chasing mirages? Has media hype taken over serious research? Are there any short cuts to serious research? Do we still find the seriousness and humility of scholarship?

I will first draw your attention to the outstanding problems in different periods of archaeology and what needs to be done to resolve them. In the second half of my talk I would like to express my fears about the neophyte archaeologists. With these newly converted friends of Indian archaeology, it does not need any enemies. Their over-zealous but misinformed efforts are not only befuddling the issues but are diverting the efforts in wrong directions.

Let us begin with the Stone Age.

Stone Age Challenges

With millions of stone tools collected and studied by several generations of scholars, we still have no human remains, except the one from Hathnora in the Narmada valley, to talk about. Again, we have huge collections of tools but hardly any excavations of primary sites. This clearly points to some serious lacunae in our research strategy. We have not looked at the potential sites, which could have given us both skeletal and circumstantial evidence to reconstruct the Stone Age life and society.

With early hominids going beyond 4 million years in Africa, we still have no substantial data on absolute chronology of our Stone Age industries and no human fossils at all to date. There is first-rate technology available in India but it can be applied to archaeology only if we are able to convince the scientists that it will be great science if we solve some of the problems of human past in India. But here the gulf between the Two Cultures remains as wide as it ever was.

Our two societies (ISPQUS & IAS) could play a meaningful role in beginning this dialogue with the scientists. The younger generation has to give a lead in this.

I am sure some of you had a chance to read *African Exodus* by Stringer and McKie. It is a very exciting and lucidly written book by two leading palaeontologists. They ask you to look at yourself in the mirror and ask questions about simple things like why there is hair on the head or armpits, why can't the jaw take a larger number of teeth, why our height is diminishing, etc. For all these simple questions there are profound answers given by human evolution. For example, the hair on the head protects us from changing radiation. The hair in the armpits and the groin allows hormones and pheromones to linger longer. The advent of agriculture has resulted in diminishing height, disease, high population, etc. In contrast, much of our Indian prehistory is mere description of tool types. We never go beyond to look at the humans who made the tools.

Let me share with you some of the excitement of new discoveries in prehistory. These are the types of question that should worry our younger archaeologists.

About the African hominid finds Louis Leakey recalls in his autobiography, *One Life*: "Geological investigations and dating have shown that the two skulls are about 130,000 years old, yet despite their antiquity they are both clearly identifiable as *Homo sapiens*, our own species. At the time of their discovery, scientists generally believed that our species had only emerged in the last 60,000 years and many considered the famous Neanderthal Man to be the immediate precursor to ourselves. The Omo fossils thus provided important evidence that this was not so."

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[1] The Tenth Prof. H.D. Sankalia Memorial Lecture, delivered on 01 12.2000, at the XXVIII Annual Conference of the Indian Society for Prehistoric and Quaternary Studies, held at the National Museum, New Delhi on 1-3, December, 2000.

Richard Leakey's work at Omo-Kibish provided scientists with a fresh start in their study of the origins of the *Homo sapiens*. Firstly, they led a few researchers, in the 1970s, to conclude that the Kibish man was a far more likely ancestor for the Cro-Magnons, a race of early Europeans who thrived about 23,000 years ago, than their immediate predecessors, the heavy-set Neanderthals. Then, in the 1980s, a new reconstruction and study of the Kibish Man revealed an even more startling possibility — that he was a far better candidate as the fore bearer, not just for the Cro-Magnons but for every one of us alive today, not just Europeans but all the other peoples of the world, from the Eskimos of Greenland to the pygmies of Africa, and from Australian aborigines to native Americans. In other words, the Kibish man acted as pathfinder for a new genesis for the human species.

Africa has recently provided more exciting news. At the town of Katanda (Zaire) was discovered an archaeological treasure trove: thousands of artefacts, mostly stone tools, plus a few bone implements that quite astonished the archaeologists led by the husband-and-wife team of John Yellen of the National Science Foundation, Washington, and Alison Brooks, of the George Washington University. Among the wonders they have uncovered are sophisticated bone harpoons and knives. "Previously it was thought that the Cro-Magnons were the first humans to develop such delicate carving skills — 50,000 years later. Yet this very much older group of Homo sapiens, living in the heartland of Africa, displayed the same, extraordinary skills as craftsmen. It was as if, said one observer, a prototype Pontiac car had been found in the attic of Leonardo da Vinci."

There is another enigma staring us at our face. By about 80,000 years ago, small groups began spreading across the globe, via the Middle East, planting the seeds of human modernity in Asia and later on in Europe and Australia. In each region, these seeds slowly germinated until, about 40,000 years ago, something caused them to blossom with an explosive population growth. The cause of the trigger of this great social upheaval is still hotly debated, but remains a mystery at the heart of our 'progress' as a species. Was it a biological, mental or social event that sent our species towards world domination? What was the trigger? Was it the advent of symbolic language, the appearance of the nuclear family as the basic element of human social structure, or a fundamental change in the workings of the brain? "Whatever the nature of the change, it has a lot to answer for. It transformed us from minor bit players in a zoological soap opera into evolutionary superstars, with all the attendant dangers of vanity, hubris and indifference to the fate of others that such an analogy carries with it (Stringer and McKie 1996)".

Let our younger prehistorians be part of such research teams and unravel these mysteries.

Rock Art Sites

In December 1994 the most spectacular painted cave near Avignon in France was discovered. The Grotte Chauvet (named after the man who found it) has galleries covered with depictions of lions, bears, rhinos, horses and deer. It also contains evidence of a cave bear shrine. Chauvet is clearly one of Europe's most significant painted caves, particularly as radiocarbon dating has revealed it to be between 30,000-34,000 years old.

On the other hand, we too have some of the richest rock art sites of the world, but we have no evidence to date them. There is a variety of material, oxalates, carbonate layers, pollen, wax, blood, honey, etc, which could provide good material for AMS dating. Now at Bhubaneswar we have an accelerator, which can be easily used for AMS dating. A beginning has already been made in this direction. I am told already they have produced some dates on Dholavira material. These expensive machines are meant for high-energy physics but if we explain our case, the physicists, they will be more than willing to help us. But are we trying? Are we using them for the advancement of Indian archaeology? I tried my best to install radiocarbon and TL labs in some dynamic archaeological institutions before I retired. But we did not find any keen hosts.

There are molecular biology techniques available today which can allow us to identify animals slaughtered with just a trace of blood on the tools. Are we concerned?

New Innovations

Science and technology have given us many new and powerful tools. Today it is possible that ancient DNA can be extracted from extinct hominids, throwing a direct light on their relationship to us. The breakthrough in molecular technology that allows tiny fragments of DNA to be located and copied in vast quantities — the Polymerase Chain Reaction (PCR) — was made by the biochemist Kary Mullis in 1983, who was awarded the Nobel Prize for his discovery. As a result, scraps of ancient DNA have now been multiplied and analysed from 40,000-year-old frozen mammoths; 18-million-year-old plant fossils, and 40-million-year-old insects entombed in amber. Progress in obtaining ancient human DNA has been slower, but Dr. Bryan Sykes of the Institute of Molecular Medicine, Oxford, collaborating with Chris Stringer, has succeeded in extracting DNA from the teeth of a 12,000-year-old Cro-Magnon jawbone from Gough's Cave in England. The DNA includes a Y-chromosome segment, confirming that the individual concerned was a boy, and mitochondrial DNA which is closely related to that of living Europeans (Stringer and McKie 1996).

Early Agriculture

Japanese and Chinese archaeologists are making momentous new discoveries in the fields of early agriculture and ceramics. They have pushed back the dates of earliest rice technology to 12,000 B.P. and beyond, and so also the origins of ceramics. Dr. T. Nakamura (personal communication, dated 24 May 1999) informs me about dating the Jomon Ware, "The age of 16,500 B.P. is a calibrated age. The ^{14}C age is 13,780 + 170 B.P.. This is the oldest age I have measured on 5 ceramic fragments this time."

According to archaeological evidence, two main agriculture systems based respectively on rice and millet cultivation appeared in prehistoric China. Neolithic cultures in the south, with a warm, humid climate, introduced the cultivation of rice. Recent progress in archaeobotanical studies has pointed to rice domestication in the middle reaches of the Yangtze River as early as 10,000 years B.C. In contrast to the south, cultures of the north were substantially dependent on millet cultivation, which was suitable to the northern environmental conditions with a drier, temperate climate (Makohonienko 2000: 4).

Yasuda (1999) reports, "the Miaoyan site and the Tongliuzhou Dalong site in Guangxi Zhuangzu Ziziqu dates back to 16,000 years B.P. (uncalibrated). Moreover, pottery dating back to 14,000-15,000 years B.P. (uncalibrated) was found at the Xianrendong and the Diaotonghuan sites in Wannianxian Jiangxi Province, and the Yuchanyan site in Hunan Province. The oldest pottery, which I saw at the Cultural Relics and Archaeological Institute of Hunan Province, was unearthed from the Yuchanyan site in Hunan Province. The pottery is greyish, with pointed base and around 1 cm in thickness. Pottery, which was as old as in the southern China, was also found at Shimomouchi site in Nagano Prefecture in Japan. It was ^{14}C dated to 16,000 years B.P.. The people, who settled down in a forest and invented pottery, also started rice cultivation. Rice cultivation originated in the middle reaches of the Yangtze Basin. Some evidence of rice cultivation was found at Xianrendong, Diaotonghuan and Yuchanyan in Hubei Province and Bashidang and Pentoushan sites in Hunan Province. ^{14}C dating revealed that the Xianrendong and the Daiotonghuan site dated to 14,000-12,000 years B.P. and Pashidang and Pengtoushan sites to 11,000-9,000 years B.P.. These are more than 5,000 years older than the Hemdu site in Zhejiang Province, which was dated to 7,000 years B.P. and considered to be the oldest rice cultivation site in China before 1991. The oldest pottery was also found at these oldest rice cultivation sites."

In China, Yasuda (2000: 1-4) writes that at the Pengtoushan site, where archaeologists found husk dating back to 9000 years, is located about 2 km southeast from the Chengtoushan site. At the Bashidang archaeological site, located about 20 km northeast of the Chengtoushan site, rice husks date back more than 10,000 years. From this evidence, the Liyang plain is considered to be one of the earliest phases where rice cultivation originated. Near the east gate, a paddy field of Tangjiagang period (about 6,200-6,300 years ago) was excavated. This paddy field is considered the oldest in the world. The phytolith analysis conducted by the Japanese team found a large amount of phytoliths from rice husks in a stratum dating back more than 7000 years ago. It indicates that paddy fields in this area may date from more than 7000 years ago.

There is every reason to expect that in the Ganga Valley, Vindhyas and Rajasthan, the beginnings of agriculture may go back to early Holocene. The Allahabad University and UP State Archaeology Department have made significant discoveries in their new sites and we are trying to get some new dates, both conventional and AMS.

There seems to be a distinct possibility that early rice technology may have entered the Ganga Valley, through the South-east Asian route through Mekong Delta, Brahmaputra, and Central Himalayas from South China. This requires a bit of digression.

Northeast Scenario & Himalayan Corridors

Affinities with East and Southeast Asia have been claimed among the faceted axe, the splayed axe and the shouldered celt found in northeast India , comprising the states of Assam, Arunachal Pradesh, Meghalaya, Nagaland, Manipur, Mizoram and Tripura. This region seems to be ethnically, linguistically and also archaeologically related to Southeast Asia. On the other hand, the types mentioned above and the cord impressed pottery connect these Neolithic cultures to Yangshao, Langshanoid of China and Hoabinhian of Thailand, thus pushing back the antiquity of such cultures to the early Holocene. We may also note here that Sharma has reported stone harvesters and celts of the Kashmir Neolithic type from Sikkim.

Mushi and Abor hills area has produced eighteen tools out of which six are made on jadeite, suggesting Chinese affinity. The splayed-edged axes have a wider distribution and are reported from Burma, Yunnan and Malaysia. Previously it was thought that the shouldered axes were cut by metal wires, but now Sharma has shown that shale and sandstone can be cut by a shell piece or slivers of bamboo and therefore knowledge of metal need not be assumed.

Even harder rocks like quartzite could first be dressed by flaking. The cultural assemblage at the site has been compared with the late Bacsonian of Southeast Asia having significant influences from Szechwan and Yunnan.

T.C. Sharma in his Presidential Address (in press) informs us that in 1990, Abdulla A. Ashraf excavated an important prehistoric site at Parsi Parlo in Lower Subansiri, district, Arunachal Pradesh and exposed (1) a pre-Neolithic Hoabinhian cultural layer without pottery; (2) a Neolithic layer with ground and polished stone tools and pottery, and (3) a Ferro-Neolithic layer characterised by a Neolithic assemblage in association with iron.

Sharma further reports that O.K. Singh excavated four Neolithic sites at Napachik, Nongpok, Laimanai and Phunan, where stratified cultural layers yielding Neolithic celts along with microliths and pottery have been unearthed. He obtained a 14C date 4460±120 B.P. for the Neolithic culture at Nongpok and a TL date 1450 B.C. for Napachik Neolithic site, thus giving us firm dates of the Corded Ware Neolithic culture of N.E. India, which were previously dated to c. 2500 and 1500 B.C. (Singh 1997).

P. Singh (1999), summarizing the survey of Neolithic cultures of Eastern India, notes that Assam was a focal region of Eastern Indian Neolithic. As regards the genesis of this culture, it is supposed to have derived its inspiration from South China and Southeast Asia. Recent discoveries made in Sikkim further demonstrate cultural links with southwest China and Southeast Asia. The adzes, Honan knife, perforated celts and harvesters are typical of south Chinese Neolithic assemblage. A similar assemblage has also been reported from Southeast Asia.

The cord-impressed ware seems to provide a link; howsoever tenuous it may look, with the East Asian Neolithic cultures. Gautam Sengupta *et al.* (1991: XIII) in the editorial note of the book, Archaeology of North-Eastern India, makes an important observation, "The relevance of the region in the Sub-continental history and archaeology can hardly be overstated. *A corridor region between Southeast Asia and Gangetic India, North-Eastern India offers a series of problems and their probable answers* (D.P. Agrawal) having very significant bearing on the entire discipline of Archaeology".

In view of these recent findings, and the early contacts of northeastern states with China and Southeast Asia, the following linguistic evidence assumes importance.

Linguistic Data

Linguistic evidence seems to provide some possible contacts with Southeast and East Asia as far as the early rice technology is concerned. Grierson (1967-68) in his linguistic survey of the Himalayas had identified some residue of Mon Khmer words in the Kumauni dialects. Mon Khmer is part of the Austro-Asiatic language group (Bayard 1996). With the new ^{14}C AMS dates from Thailand, the copper metallurgy there can be pushed back to II-III millennia B.C. White (1997) reports, "The earliest evidence of bronze at Ban Chiang appears by Early Period II/III in both burial and non-burial contexts. The calibrated results...indicate an early II millennium B.C. date for this part of the sequence." White further says, "the 3KUM dating and pollen evidence is broadly consistent with Blust's (1996) linguistic arguments for the expansion of rice-cultivating, Mon Khmer speaking societies down the Mekong from south-western China beginning by the late 6th millennium B.C.". Higham, however, thinks that KUM dates are just burning episodes in the Lake Kumpahawapi pollen cores and have no necessary relationship with agriculture. He says that the earliest date for agriculture in Southeast Asia is about 2000-2300 B.C. from Non Pa Wai, Ban Kao, southern China. Higham (personal communication.) has pointed out that "Non Nok Tha is a cemetery dated to the period 1500-1000 B.C." This late date however is not acceptable to others. The dates quoted by White from 3 KUM come from a sediment core. The evidence is consistent with land clearance in the early 5th millennium B.C.. Such a date seems to accord well with the linguistic argument of Blust (1996). Our experience from the Rajasthan lakes has also been similar: the advent of Cerealia type pollen is accompanied (c.7000 B.P.) by finely comminuted charcoal, which has been interpreted as clearance for agriculture (Singh *et al.* 1990:351-358). Higham seems to conflate the expansion of the Austro-Asiatic language family with the spread of a specific type of pottery and arrives at the date of 2000-3000 B.C. as mentioned above. Basically the difference between the positions of White and Higham lies in the estimation of the gap between the advent of agriculture and metallurgy. White argues for a 6th millennium B.C. beginning of agriculture accompanied by the expansion of the Mon Khmer family of languages, as argued by Blust (1996), and a substantial time gap between the advent of agriculture and metallurgy. Higham, on the other hand, thinks that this gap could be only a few hundred years.

Unfortunately in India the Northeast is still archaeologically not so well studied. It will be interesting to define the gap between the advent of agriculture and copper metallurgy through the Himalayan corridor. The movement of Munda speaking people along the Himalayan corridor, however, is generally agreed upon.

Now let us see how this evidence is relevant to the Central Himalayas. In Kumaun, the shilpkars, earlier called Doms, are supposed to be Kols, speakers of Munda dialects (Sharma 1988). Munda and Mon Khmer dialects are two branches of the Austro-Asiatic family. There are many Austro-Asiatic aboriginal languages still spoken in Thailand (Bayard 1996). Elsewhere we have discussed

(Agrawal & Kharakwal, 1998) that the Kols are said to be the first ethnic group of Kumaun which had descended from the Munda speaking group, which is related to the Austro-Asiatic sub-groups (Majumdar and Pusalkar 1952: 565). They represent the aborigines of Kumaun. Doms (shilpkars) are perhaps the modern representatives of the Kols (Atkinson 1980-81: 370), who today occupy the lowest rung in the hierarchical status in Kumauni society and are now included among the Scheduled Castes. They also claim to have been in Kumaun before either the Khasiya or the immigrants from the plains. The Doms are the traditional smiths in Kumaun.

Higham (1996) discusses the relationship between the Austro-Asiatic and Austronesian languages and whether they belong to a common ancestral Austric phylum and its implications for archaeology. In view of the recent work by Reid (1993, in Higham 1996) and Blust (1993, in Higham 1996), Higham tends to agree with the Austric hypothesis as it would require only one Neolithic expansion and spread of rice cultivation which, according to him, is better supported by archaeological evidence. He describes the SE Asian rivers as being like spokes in a wheel, "with the hub in the eastern foothills of the Himalayas... In a westward direction, ancestors of the Munda moved, perhaps down the Brahmaputra into eastern India (Higham 1996:115)." Obviously, the movement did not stop there but went further westward to the Central Himalayas. This type of Southeast and westward movements probably explains better the expansion first of the rice cultivation and later on of metallurgy.

Synthesising the archaeo-linguistic evidence Bayard (1996) agrees, "It is very tempting to correlate this with the westward expansion, under the stimulus of agriculture, of Austro-Asiatic (AA) language from Nanhailand through Viet Nam, Laos, Cambodia and Thailand to Burma and ultimately eastern India. Linguists have reconstructed a number of terms related to agriculture in Proto-Munda, and some of these (husked rice, rice husking pestle) appear to go back to Proto-AA as well. It has been generally agreed for some time now that the prehistoric and early historic inhabitants of Thailand and Burma spoke languages of the Mon-Khmer branch of AA (Bayard 1979: 270). Such an expansion would account neatly — in a general sense for the distribution of the AA languages."

In fact, the new discoveries in China and Japan, mentioned above, push back the antiquity of rice and ceramic technology further and make is possible to expect early Holocene dates of earliest rice technology in the Ganga Valley and the Vindhyas.

This is another challenge we face: Is it possible that early rice and ceramic technology reached the Ganga Valley and the Vindhyas from China and Southeast Asia, through the Himalayan corridors?

It is of course important for us to know when early agriculture and ceramic technologies began in India. On the other hand, we have also to realise that agriculture was not an unmitigated boon for humanity.

Agriculture had a devastating effect on health. Although it is often promoted as the great technological achievement that freed men and women from the drudgery of hunting and gathering food, farming took a grim toll of its practitioners. Healthy hunter-gatherers were suddenly turned into sickly farmers. Tooth cavities jumped seven-fold; children's teeth defects reveal their mothers were badly undernourished; anaemia quadrupled in frequency; tuberculosis, yaws, osteoarthritis, and syphilis afflicted large numbers of the population; and mortality rates jumped. Almost a fifth of the population died in infancy. Far from being one of the blessings of the New World, corn was a public health disaster. It is a story repeated time and again round the world. Stringer and McKie ask the question: Why on earth did *Homo sapiens* turn its spears into ploughshares in the first place? If agriculture has brought such medical disasters down upon our heads, why did we plump for lives tilling the land? The answer is simple: sheer force of numbers. Farming a piece of land can support ten times the number of people who would live off it as hunter-gatherers.

"Documented dispassionately, it is clear that ours is the behaviour of a species no longer living in harmony, or more prosaically, in balance with nature. The consumer and consumed are out of kilter with each other... This is *Homo sapiens*, an omnivore fresh out of Africa that requires 3,000 calories of energy a day but which has nevertheless soared from around ten thousand individuals 100, 000 years ago to an estimated ten billion in the near future — a million-fold increase in a few millennia." 'Our planet cannot withstand such numbers,' says Peter Ward:

> To realise enough organic productivity, virtually the entire arable land surface of the earth — every forest, every valley, every bit of land surface capable of sustaining plant life, as well as much of the plankton of the sea — will have to be turned over to crops if our species is to avert unprecedented global famine. In such a world, animals and plants not directly necessary for our existence will probably be a luxury not affordable. Those creatures that can survive in the vast fields and orchards will survive. Those that need virgin forest, or undisturbed habitat of any sort, will not.

Bronze Age Issues

Indus Civilization or Harappa Culture is a landmark in our history. It makes us proud to note that it gave the world its first planned towns, civil sanitation, standardised weights, linear scales, a binary system, true saws, hollow drills, needles with hole at the pointed end, and devices to beat heat. The Harappan houses had a central courtyard, which set an air circulation allowing hot air to go up and cool air to sink in. Its houses opened into narrow lanes, and not into main roads, because narrow lanes are always cool, the sun can never beat through them. The lanes of Banaras are cool even at the peak of summer.

Above all, it was a peaceable society, not a warlike people. And even the elite is marked by humility. The Harappan towns present a contrast to the Mesopotamian and Egyptian towns. Mark Kenoyer (1998) thinks that the Indus rulers governed their cities through the control of trade and religion rather than with armies. No monuments were erected to glorify their power. The stamp seals of the elite with symbols of wealth and power separated them from common people. Large buildings of the elite were not located in a single area of the town, but were spread all over the different mounds, unlike the layout of the Mesopotamian cities. Even the burials are simpler affair, unlike the grandeur of Egypt or the wealth of Mesopotamia. Kenoyer contrasts Mesopotamia and Egypt where stone sculptures and relief, of kings were made, unlike in South Asia. Asok built more than 115 stone columns but none of them had the portrait of the king.

They have left us a rich cultural legacy to be proud of. Does this legacy become greater or lesser if they were Aryans or if they were not? There are more substantive issues to worry about than offering the great Harappa culture on a platter to the Aryans.

Why should they import copper from Oman, when we had rich copper belts in Rajasthan and Central Himalayas? Why Jodhpura Complex seems to be specializing in copper metallurgy and manufacture of artefacts of Harappan vintage? There is no evidence of smelting in any of the Harappan towns. Were village-based societies producing copper ingots and copper artefacts for supply to the Harappans. What is the secret of the rich silver and gold finds of Kunal? Was Rakhigarhi, with its copper rich hinterland, controlling the supply to the Harappans? What benefits were the Jodhpura people getting for running such dirty industries? With tin now found in Tusham hills in Haryana, they could have provided well-controlled bronze ingots to the Harappans (Agrawal and Kharakwal in press).

In Rajasthan and in Gujarat an indigenous development of local Chalcolithic cultures towards urbanization seems to be taking place, not much affected by the Big Brother Harappans. What does it signify for our cultural development?

Iron Age Problems

Iron Age also has a suite of glaring outstanding issues, which demand our attention:

- If iron technology is indigenous to India, what and where are the technological stages?
- Where are the early examples of the production of the accidental iron during copper smelting?
- Did we use meteoritic iron in India?
- Why was cast iron making so late in India? What are the stages of steel making? Was there an ornamental stage of iron use in India too when it was valued as a precious metal?
- What are the developmental stages of making Wootz steel and how extensive was its use.
- In what way iron contributed to the socio-economic processes associated with the second urbanization?
- When did iron effectively replace bronze and stone?
- What role Central Himalayas played in providing iron and its technology to the Ganga Valley?
- Did early iron technology come with some Indo-Aryan groups?
- How are the multiple foci of early Iron technology related to each other, if at all?
- What is the absolute chronological framework of early Iron Age based on calibrated radiocarbon and TL dates? Now that AMS dating is going to be available at the Institute of Physics at Bhubaneswar, we should be able to date the actual iron artefacts and slag so that there is no ambiguity about relating the age of an iron artefact and the date based on charcoal.

With so many research problems claiming our attention, should we confine ourselves to the trivial and in fact irrelevant problems, which are not going to throw any light on our illustrious past?

Finally, let me bring to your attention some basic traits of our society and also our concepts.

The Idea of India

According to Khilnani, in Nehru's view, India was a society neither of liberal individuals nor of exclusive communities or nationalities but of interconnected differences. In Nehru's imagination, India appeared as a space of ceaseless cultural mixing, its history a celebration of the soiling effects of cultural miscegenation and accretion, 'an ancient palimpsest on which layer upon layer of thought and reverie had been inscribed, and yet no succeeding layer had completely hidden or erased what had been written previously'. Nehru's understanding of the India's past, was committed to protecting cultural and religious difference rather than imposing a uniform 'Indianness'.

The idea of India that we have today is not an eternal unchanging concept. "What made possible the self invention of a national community was the fact of alien conquest and colonial subjection. It was the British interest in determining geographical boundaries that by an act of

Parliament in 1899 converted India from the name of a cultural region into a precise, pink territory (Khilnani 1998)." When in Mehrgarh in Baluchistan, the foundations of the Harappa Culture were being laid in the VI-V millennia B.C., what constituted India? In the India of the Harappa Culture, the Ganga Valley does not come into the picture. Was India of the Mauryans, of the Guptas, of the Mughals and of the British the same? Is India of pre-1947 and post-1947 the same? Nations are essentially spatio-temporal concepts, which change with time and geography. So let us not get bogged down into such mires but address the more substantive and challenging issues.

When such outstanding problems are staring at our face, non-issues are diverting our attention. The neo-converts to archaeology — coming from diverse backgrounds, from physics to fiction — seem to have taken over and the older archaeologists who have devoted a life time in their disciplines are being taught how to interpret the past, how to decipher the Indus script, how to trace the roots of the Indian Civilization (Singh 1995; Jha and Rajaram 2000). And finally, I would like to make a plea to get rid of this extra baggage of neophyte archaeology, which is neither sound nor sensible and is bringing bad name to our great traditions of scholarship.

More important is the feeling of human brotherhood that prehistory imparts. It is the common origin of all humanity from Africa. The Kibish man from Ethiopia was the humanity's common ancestor. Slightly changing the metaphor of Alex Hailey's famous book, Roots, Stringer and McKie (1996: 234) say about the man from Kibish, "He is humanity's African kin. He is us and we are him."

In this age when palaeontologists are arguing about common ancestry of all humankind, do we have to worry only about the Aryans (see Agrawal 2000: 3-6; Witzel 2000: 4-14)? If the Indus Civilization is not identified with the Aryans, does it belittle this great civilization? Is it not enough that they were our venerable ancestors - Dravidian, Aryan, African or whatever? As we have seen above, there are outstanding problems about our understanding of the Indus Civilization and other periods of our past, which urgently need to be addressed. These problems are more tangible and meaningful about our past than offering the Indus Civilization on a platter to the mythical Aryans.

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Emergence of Early Harappans in North Gujarat*

Abhijit Majumdar

Department of Archaeology and Ancient History
M.S. University of Baroda
Vadodara 390 002

Abstract

The paper deals with the penetration of the Early Harappan community into northern Gujarat during the first half of the third millennium B.C. The factors attracting people to this area are discussed. Possible routes taken by this community, the area from where they might have migrated are considered and an attempt is made to date the Early Harappan migration.

Introduction

The presence of Early Harappans in Gujarat, more specifically in North Gujarat and Kachch, has been well established now (Possehl 1999: 595-615; Majumdar 1998, 1999). Early Harappan pottery from the burials at Nagwada and Surkotada was the first indication of an Early Harappan occupation in this region. The ceramics associated with these burials show a close affinity to the Early Harappan pottery from Sindh and Baluchistan. Nine additional sites have since been discovered in the region of North Gujarat with evidence for Early Harappan ceramics from regular habitation deposits. These discoveries settle the issue of the penetration of the Harappans into Gujarat during their formative stage. Consequently, certain pertinent questions that arise, which have been pointed out by some scholars, such as Possehl (1999). There are "Who were these Early Harappans?", "What attracted them to this part of the country?", " What was the route taken by this community?" and "When did they finally arrive in this region?"

Most of the settlements belonging to the Early Harappan community in North Gujarat are small and the habitation debris at these sites is very meagre, giving a less than comprehensive picture about the community who inhabited these settlements. The region of Kachch and North Gujarat has adverse climatic conditions such that it could have barely sustained a hunting-gathering community, let alone attracting an agricultural population. Regarding the time of their appearance in this region, there are no radiocarbon dates available from these small Early Harappan settlements, in spite of systematic digging at least six of these sites, to provide an absolute date of their existence. It, therefore, becomes necessary to dwell on these aspects at length and come up with some logical suggestions. An attempt has been made here to evaluate the evidence available from these Early Harappan settlements. A short review of the archaeological evidence for this period is given below.

Early Indigenous Chalcolithic Communities of Gujarat

Until recently, it was assumed that the earliest settled Chalcolithic communities in Gujarat were associated with the Mature phase of the Harappan culture (c. 2500-2000 B.C). Rao (1979) during his Lothal excavation found ceramics showing some features different from the Harappan pottery in the earliest levels. He termed the pottery "Micaceous Red ware" and assigned it to a regional ceramic group with a possible early origin. Sankalia (1974: 369, 379) also hypothesized an early origin for the Micaceous Red ware at Lothal and Rangpur. However, no serious consideration was given to these findings, as they were not found from any secure independent context.

The site of Prabhas Patan, on the southern coast of Saurashtra, was re-excavated during early 1970's by the Deccan College and the Gujarat State Archaeology Department. The ceramics of this assemblage which, directly overlies black soil, is represented by Burnished Red/Grey ware, Black-and-Red ware, Incised Red ware and fine Grey ware along with a few small finds like segmented faience beads and a flake-blade industry of chalcedony. This assemblage has been termed the Pre-Prabhas culture. It is overlain by the Early Prabhas culture (period II). Two radiocarbon dates for Pre-Prabhas phase give a time bracket of 3000-2800 B.C (Dhavalikar and Possehl 1992) (Table 1). Prabhas Patan thus, provides the evidence for a settled Chalcolithic community in Gujarat at least half a millennium prior to the Harappans.

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Explorations and excavations in North Gujarat during the last two decades have demonstrated that the region was occupied by a regional Chalcolithic culture termed later as the Anarta Tradition (Ajithprasad and Sonawane 1993). The Anarta Tradition has a ceramic repertoire consisting of Gritty Red ware, Fine Red ware, Burnished Red ware and Burnished Grey ware. This Chalcolithic phase has been dated to the second half of the fourth millennium B.C. at the excavations at Loteshwar, situated in Sami Taluka of Mehsana District by two radiocarbon dates (Sonawane and Ajithprasad 1994: 136) (Table 1).

Padri, another site in the southern coast of Saurashtra in Bhavnagar District, has evidence for another ceramic tradition named Padri ware. This ware also is dated early, as seen from the dates given in Table 1. This ware occurs in the lowest 60 cm of the mound and is period III of the excavator. Other than pottery, a large number of steatite microbeads, a globular bead of carnelian and a few short blades of chert have been found from this level (Shinde 1998: 177). Period II which belongs to the mature phase of the Harappan culture, is found immediately above Period III. Two radiocarbon dates for Period III-Padri culture gives a time bracket of 3500-2900 B.C (Shinde 1998: 173) (Table 1).

Another ceramic tradition is the so-called Sorath Harappan. This has been interpreted as the regional manifestation of the Harappan culture in Gujarat. It is found associated with it from the earliest phase of the Mature Harappan culture upto the Post-Urban Harappan phase, at least in Saurashtra, where it is the predominant ceramic type. However, I differ with the interpretation of it being the regional manifestation of Harappan culture. At Lothal, the Sorath Harappan pottery group has been associated with the first occupation of the Harappans at the site, which is dated to about 2500 B.C. On the other hand, at Bagasra, a Mature Harappan site, situated in the northern part of Saurashtra, and being excavated by M.S. University of Baroda, the appearance of the Sorath Harappan is seen from the middle phase of the Mature Harappan occupation, which can be tentatively dated to 2200-2100 B.C. Rojdi, a site in central Saurashtra, is an exclusively Sorath Harappan site and is devoid of any Sindhi Harappan artefacts. The earliest phase, Rojdi A, gives a large number of radiocarbon dates and at least five of them show a date as early as 2650 B.C (Possehl and Raval 1989: 12) (Table 1).

Table 1: Radiometric Dates from Chalcolithic Sites of Gujarat

Site	Period	Culture	Lab no	5568 bp	5730 B.C.	Calibration	Reference
Padri	Period III		PRL 1785	4390±90	4520±90	3048 BC	Shinde (1998)
			PRL 1787	4820±100	4960±100	3680 BC	do-
Prabhas Patan	Period I	Pre-Prabhas	PRL 90	4240±110	2415±115	2982 BC	Dhavalikar and Possehl (1992)
			TF 1287	4280±105	2460±110	2911 BC	-do-
Rojdi	Rojdi A	Sorath Harappan	PRL 1089	3865±115	2035±125	2640-2150 BC	Possehl and Raval (1989)
			PRL 1093	3920±105	2090±115	2645-2310 BC	-do-
			PRL 1087	4010±105	2180±115	2680-2515 BC	-do-
			PRL 1085	4020±105	2190±115	2680-2515 BC	-do-
			PRL 1285	3740±140	1900±145	2410-1945 BC	-do-
			PRL 1284	3810±100	1980±105	2415-2135 BC	-do-
			PRL 1283	3980±100	2140±105	2650-2385 BC	-do-
Loteshwar	Period II	Anarta	PRL 1564	4460±110	2510±110	2921 BC	Sonawane and Ajithprasad (1994)
			PRL 1565	5050±110	3100±110	3698 BC	-do-

There are other sites in Saurashtra, like Nageswar (Hegde *et al.* 1990), which is a pure Sindhi Harappan site, devoid of any Sorath Harappan materials. This indicates that the Sorath Harappan was not always necessarily associated with the Mature Harappans in Gujarat or *vice-versa*. The association of the Sorath Harappans with the Sindhi Harappans dates to different periods at various settlements. It is, therefore, more likely that the Sorath Harappan ceramic belongs to a group of people who were the indigenous people of Saurashtra, having an early origin, and who later came in contact with the Mature Harappan community. The antecedent phase of the Sorath Harappan is still not clearly known and only future work in this direction would further clarify the picture. It is, therefore, more realistic to regard the Sorath Harappans as another regional Chalcolithic culture of Gujarat with a probable early origin, which co-existed, with the Harappans in Saurashtra, and Gujarat.

Dholavira is another site in Gujarat, which had a pre-Harappan occupation at the earliest level. A well-developed fortified settlement is found from the very first phase of occupation. However, the evidence indicates that the first settlers of Dholavira came with a prior knowledge of a planned settlement, metallurgy and a developed ceramic type. As very little, other than the town planning, has been published about Dholavira (Bisht 1989-90, 1997), nothing much is known about the early inhabitants of the site.

It is therefore, beyond doubt that Gujarat was not a cultural void during the first half of the third century B.C., but was already inhabited by a few settled Chalcolithic communities, which had an indigenous early origin. These were the pre/non-Harappan indigenous Chalcolithic communities of Gujarat.

Potentiality of North Gujarat Region

Looking at the present environmental conditions, and with an assumption that the climatic conditions have not changed drastically in the last four thousand years, the region of North Gujarat does not appear very conducive for a very large-scale settlement. The region, at present, falls under a semi-arid environmental zone having scanty and irregular rainfall averaging around 750 mm a year. The rivers flowing through this region, including the Banas, Saraswati and Rupen, are fed by the monsoon rains and are ill suited for irrigation (Lashing 1968). Even the ground water in this region is brackish and saline. These factors make it unlikely that the agricultural potential attracted Harappan settlement into this region. Alternative attractions for the Harappans to settle in this area therefore have to be considered.

Physiographically the Rann is an important division of North Gujarat as the whole western edge of the region is covered by the Little Rann. The traditions of the Rann being an arm of the sea are both persistent and persuasive. Scientific study of a limited nature shows that the Rann was deeper than 4 m. about 4000 years ago and with the sea level of the being 2-3 m. higher than today (Gupta 1977 a , b). Even historical accounts and local traditions maintain that ships were moving in the Rann until the 18th century (Chitalwala 1982). Presently, in the beginning of summer, seawater, aided by strong southwesterly winds, starts encroaching upon the extensive mud flat of the Rann. The monsoon rivers further contribute a large volume of water and the entire tract goes under a sheet of water which is generally 30 to 91 cm deep although, at places it is deeper than 2 m. From November to March, the Rann remains dry except for a few patches of water here and there.

It is therefore likely that there was a navigable sheet of water or deep meandering channels and the Harappans made full use of them avoiding travel on the high sea. The Rann, as part of the sea, also might have provided the raw material for the shell industries as well as contributing marine food resources.

The second important resource of North Gujarat is the grazing land. Today livestock raising is the mainstay of the rural economy in this region. Both the banks of Rupen river, the eastern border of Little Rann and large areas of waste, where many Harappan sites have been found, have an excellent growth of grasses like ***bokana*** *(Cressa cretica)*, ***soma*** *(Echinochola colonum)*, ***jinko-soma*** *(Panicum flaridum)*, *zinzvo* *(Anoropogan pumils)* etc. (Bhan 1990).

The advanced technology developed by the Harappans in manufacturing stone tools as well as stone and shell ornaments and their export to far off regions required a large amount of raw material. Though the mineral resources are limited in North Gujarat, raw materials like shell, semi-precious stones, steatite, amazonite, copper and stones like quartzite, granite, lime stone, marble and china clay, are available in this region and could have been of commercial and industrial use for the Harappans. These mineral resources would have been an additional attraction to settle in this region as a number of sites show the remains of industrial activities exploiting these natural resources.

The region of North Gujarat is an important area connecting Kachch with Saurashtra and mainland Gujarat. If the Harappans had come from Sind to Kachch via a land route, this region might have been used by the Harappans for their migration further south.

What Attracted the Early Harappans?

After critically examining the nature of sites in North Gujarat many reasons emerge which could influence the settlers. The settlements in this region are essentially small, the majority being smaller than three hectares with the cultural deposit sometimes a little over one meter. This indicates that the settlements were not occupied for a prolonged period and the occupation depended on subsistence farming and livestock raising.

The pattern of settlements of the Early Harappan community of North Gujarat does not differ much from the pattern of settlements adopted by the indigenous Chalcolithic communities who continued to thrive in this region even during the subsequent centuries. Almost all the Chalcolithic settlements in North Gujarat are situated on top of fossilised sand dunes. These dunes are invariably associated with a small depression that accumulates monsoon run-off and carries water for at least seven to eight months.

The present study shows that the sites belonging to the Early Harappan phase are very rare in the southwestern part of North Gujarat, in the Rupen estuary. Only two sites, Nagwada and Panchasar, have so far been located in this part of North Gujarat. The number increases to nine as one moves further northwards into the estuary of Banas and further north. No such sites have so far been reported from the estuary of the Saraswati.

Of the eleven sites belonging to the Early Harappan phase, six have been excavated so far. Early Harappan pottery occurred only in the context of burials at two sites while at the other four it occurred in the habitation levels. It is interesting to note that so far, there is no evidence of burials in the latter sites. As the information available for the rest of the sites is from surface survey, it is difficult to ascertain the context of this pottery. However the amount of pottery recovered from these sites and their distribution on the mound, along with the presence of this group from the habitation at few excavated sites, suggest that they belonged to the habitation levels.

The settlements belonging to the Early Harappan phase are very small, the smallest being 0.01 hectare. The artefacts scattered on the mound are found in small clusters and the habitation deposits are very superficial, with the exception of Moti Pipli. No structural remains were encountered at any of the sites, though a few post-holes were found from the same levels as the burials at Nagwada. The important aspect in the settlement pattern of this community is that the settlements are situated within the radius of about 20 km from Moti Pipli (Fig. 1).

Moti Pipli, measuring about 3 hectare with a deposit of 50 cm, is a comparatively large site. This is the only site, for which any artefacts of this culture other than pottery were found. Because of the badly disturbed nature of the mound, no structural remains could be unearthed. Small-scale craft activity of shell and stone was carried out at the site, evidence of which can be seen from the industrial waste and debitage. A few copper implements have also been found from the same context.

Industrial debitage and finished products of stone, shell and terracotta suggest that some kind of manufacturing activity was carried out at Moti Pipli and local resources were exploited for acquiring raw materials (Fig. 2-4). Metal was not unknown to the inhabitants of Moti Pipli as quite a number of copper artefacts were recovered from the site (Fig. 5).

It is possible that the Early Harappans were attracted to the region to extract these raw materials. Gastropods like *Chicoreus ramosus*, *Fasiolaria trapezium*, *Turbinella pyrum*, *Lambis truncata sebae* etc. are found along the southern shore of Gulf of Kachch (Kenoyer 1985: 301) while Ratan Timba in Banaskantha District and Mardek Bet in Little Rann of Kachch are known for rich deposits of semi-precious stones (Ajithprasad: personal communication). Evidence from Datrana show that the well developed lithic industry, associated with the Pre-Prabhas pottery at the site, might have attracted the Early Harappans whose presence is seen at the later phase of the occupation (IAR 1993-94, 1994-95).

Another factor that might have attracted the Early Harappans into this region is the vast and rich pasturelands. The sites in the region of North Gujarat are found in clusters, located close to each other on the margins of the eastward extension of the depression which connects the Great and the Little Rann of Kachch. Clustering of sites could also be seen around Korda and Jhandada, on either side of a very large depression, locally known as *Sandher* (Ajithprasad and Sonawane 1993). These low-lying, flat wastelands generally remain marshy throughout the year and are designated as salty waste. Although they are unsuitable for agriculture, they form good pastureland for cattle and sheep/goat, as these lands support many types of grass.

The spread of the artefacts, thin habitation deposits and close clustering of the sites with very few permanent structural remains indicate that these were temporary settlements or pastoral camps, occupied seasonally. A large number of cattle and sheep bones collected from the sites indicate that they formed an important part in the economy of the Chalcolithic settlements.

Even today pastoralism plays an important role in the subsistence economy of the people in North Gujarat. Looking at the evidence gathered from the settlements, it can be postulated that pastoral activity was prevalent even during the Harappan times in this region. Agriculture, if at all practiced, might have been on a small scale.

From the evidence gathered from the region of North Gujarat, it could be inferred that their adaptive responses to the ecological situations might have included

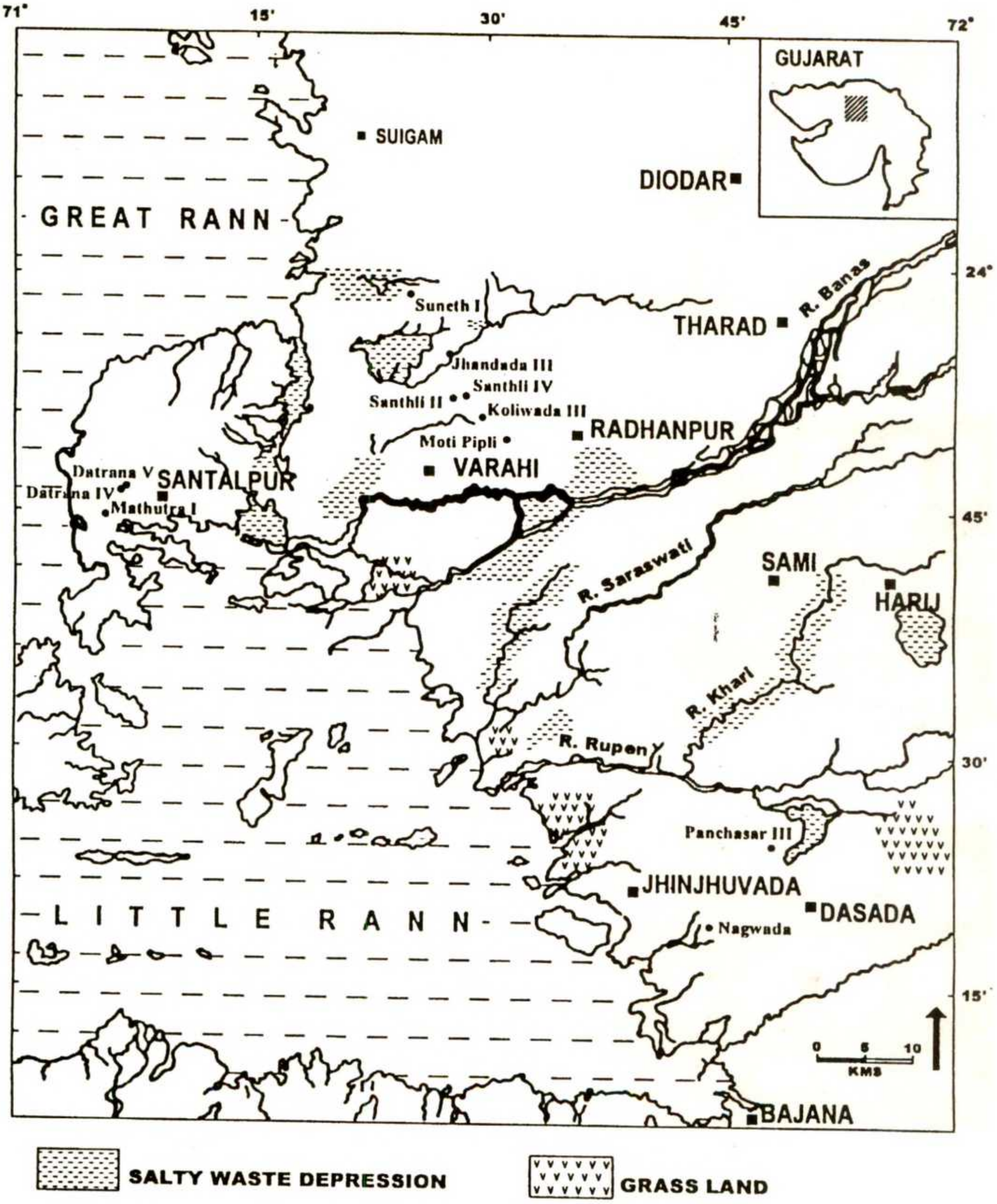

Fig. 1: Early Harappan Settlements from North Gujarat

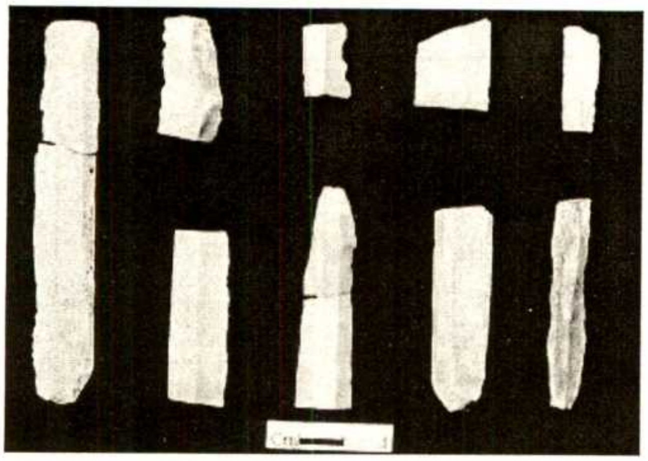

Fig. 2: Rohri Chert Blades from Moti Pipli

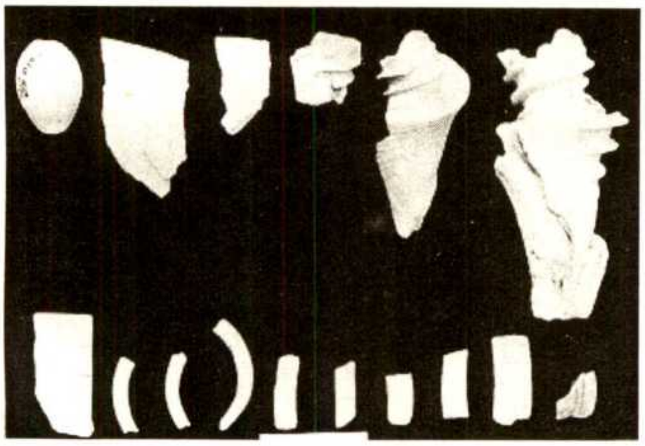

Fig. 3: Shell Debitage and Finished Products from Moti Pipli

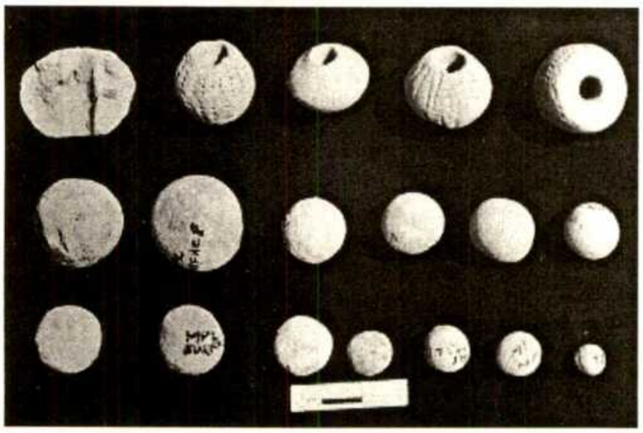

Fig. 4: Terracotta Beads and Pallets from Moti Pipli

agro-pastoralism. The Early Harappans are known to have utilised different ecological niches within the Greater Indus Valley, including different subsistence practices as seen in southeastern Sindh, the Gomal Valley, Bannu Basin and Cholistan (Mughal 1990).

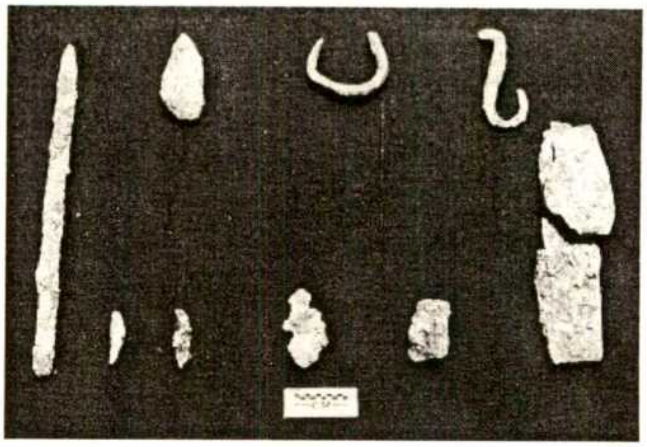

Fig. 5: Copper Objects from Moti Pipli

It is known that a certain kind of exchange system exists between the migratory hunter-gatherers and pastoralists with the settled communities. At present also such exchange systems are seen. The pastoralists and hunter-gatherers sell young animals, dairy products, woolen textiles etc. or honey, animal skins, baskets and other products of the wild and buy cereals, cloth, tobacco, and iron axes and knives (Allchin 1977). They also act as carriers of all sorts of goods and sometimes as labourers.

The interaction of the sedentary and non-sedentary population during the Harappan times has been demonstrated at Lothal and Langnaj (Possehl 1980: 67-77). A similar trade network might have been prevalent in North Gujarat where the Early Harappan pastoralists procured and traded raw materials with the settled community.

A complex interaction system might have been prevalent in North Gujarat where the pastoralists carried out dual activity of herding their animals as well as procuring raw materials.

Early Harappan Ceramic Tradition

Early Harappan ceramics are represented by Red ware, Buff ware and Grey ware. This group is distinct from the Anarta and Mature Harappan pottery in shape, decoration and surface treatment. A few imitations of Early Harappan shapes in Gritty Red ware is also seen. Red ware is the most prominent type in this group (66.71%), followed by Buff ware (16.26%). Comparatively, Grey ware has very little appearance (3.62%). Gritty Red ware forms 13.41% of the total assemblage.

Overall, the vessels in this group of pottery are made of well-levigated fine clay, sometimes showing a concentration of minute mica particles. Sand is mostly used as temper, the size of which varies from fine to coarse. These

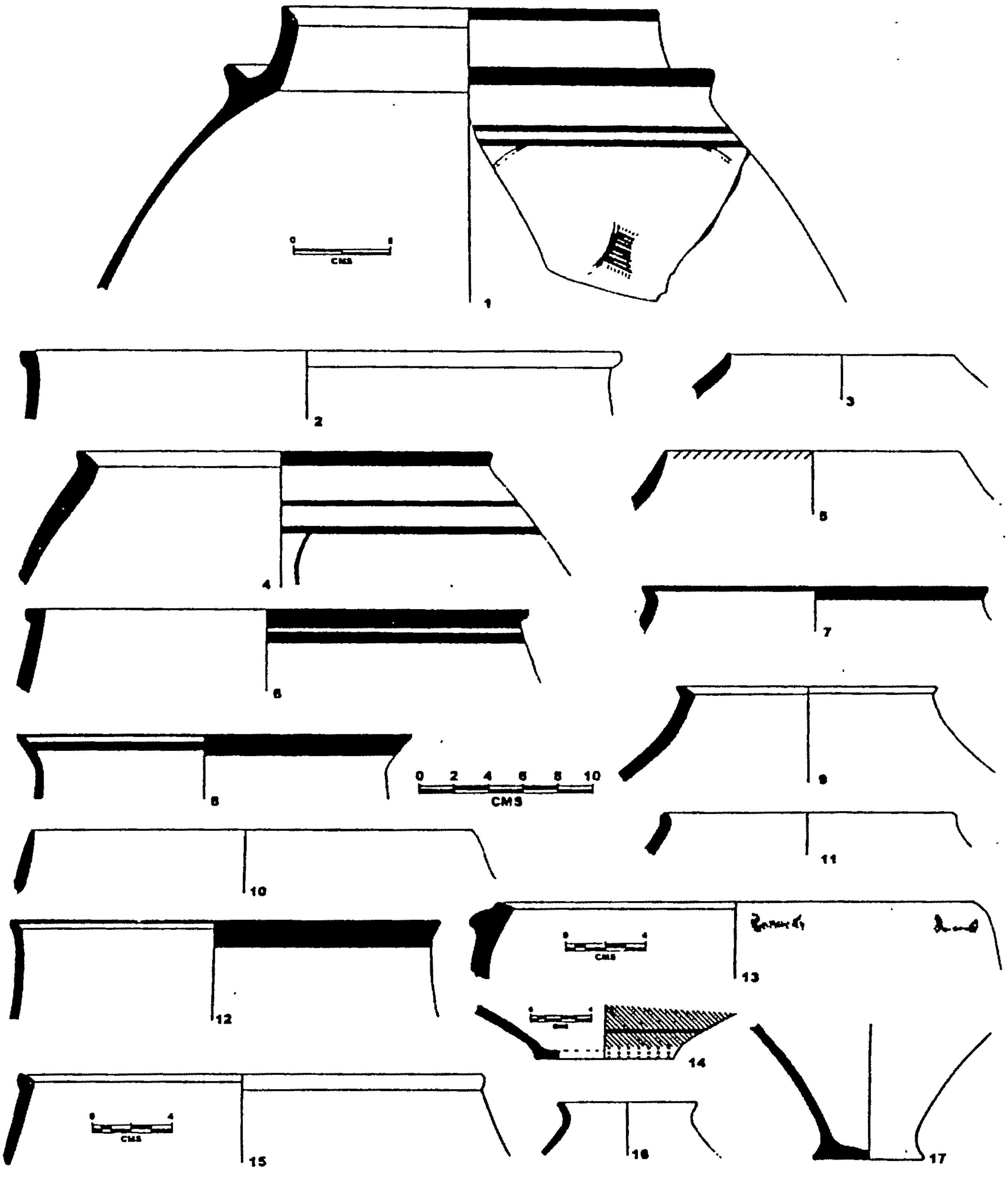

Fig. 6: Early Harappan Jarts and Pots from North Gujarat

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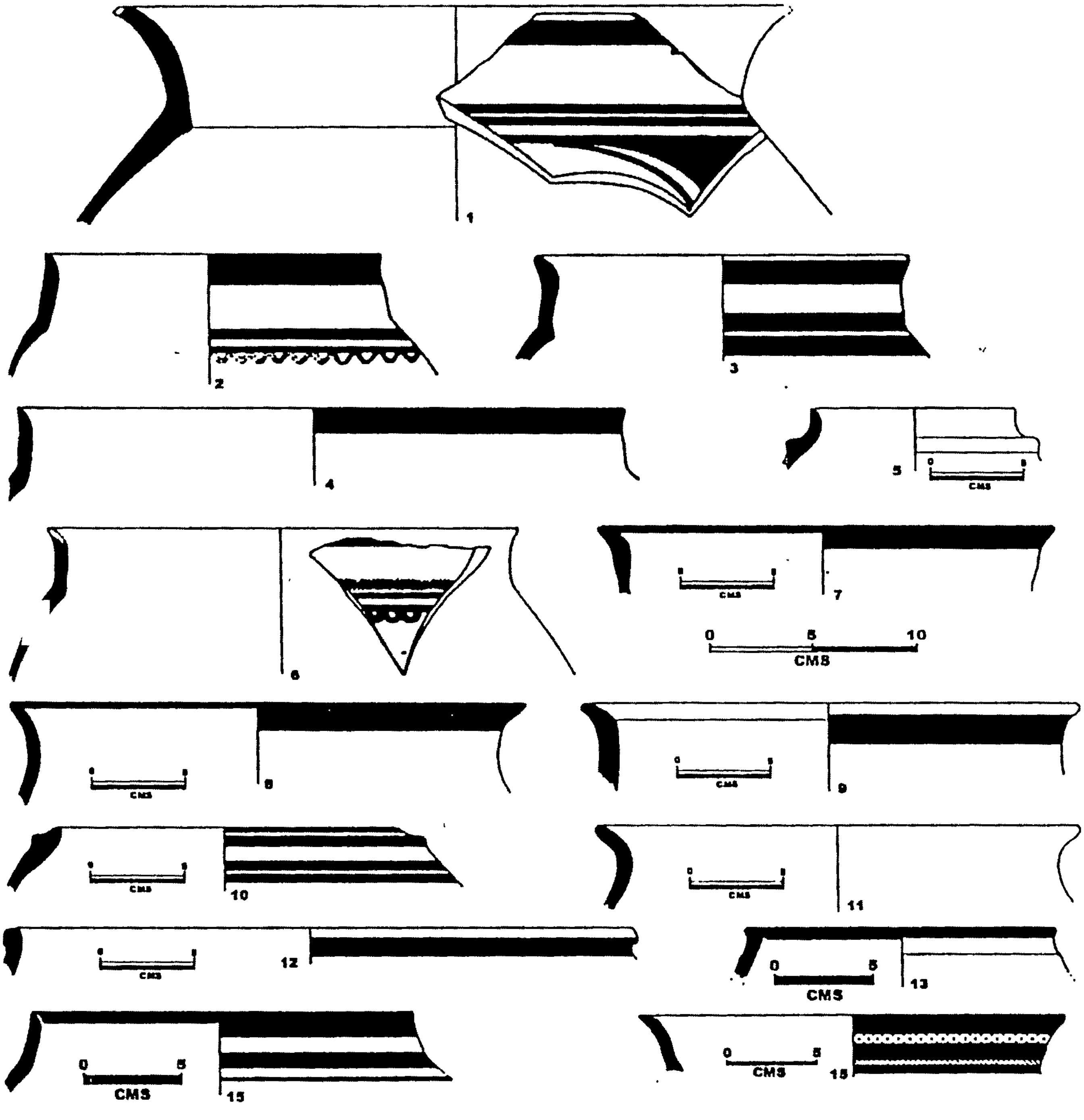

Fig. 7: Early Harappan Jars and Pots from North Gujarat

vessels are generally wheel made although some of them were definitely hand-made and show features of scraping and paring on the surface. The vessels seem to be potted on a slow, wobbling wheel as seen from irregular and deep striations. In case of large vessels, luting marks at the rim/shoulder and at the base part can be seen.

The rim part of the vessels is generally shaped on the wheel. Simple rim forms are usually found in this vessel category that are nearly vertical, everted or flaring. A flange or ledge was sometimes added. The body part of the large vessels is shaped by using the dabber and anvil method. The lower body and base of the vessels are formed on the wheel and are then trimmed, although use of dabber and anvil can be seen in a few cases.

Generally, the vessels in this group were evenly baked but many of them lacked the toughness of the well-baked vessels. This may be because the vessels were baked for a prolonged period, but the temperature was not high enough to impart the toughness to the pottery. It gives a straight fresh fracture but the edges tend to get rounded easily.

The shapes of the vessels can be broadly classified into five categories, jar and pot (Fig. 6-7), beaker (Fig. 8), bowl, dish and pedestaled vessel (Fig. 9-11).

Most of the vessels in this category were treated with a slip or a wash. The external slip sometimes extends up to the inner surface of the rim giving a band like appearance. Often a thin wash or self-slip in cream is also seen on the external surface of the vessels on which a second slip is applied. Occasionally a slipped band, unslipped surface and painted bands are the components of a slipped-cum-unslipped surface treatment with 'bichrome effect'. The colour of the slip ranges from red to yellow red to brown. Multiple grooving on the exterior surface of the vessels is also seen in few cases.

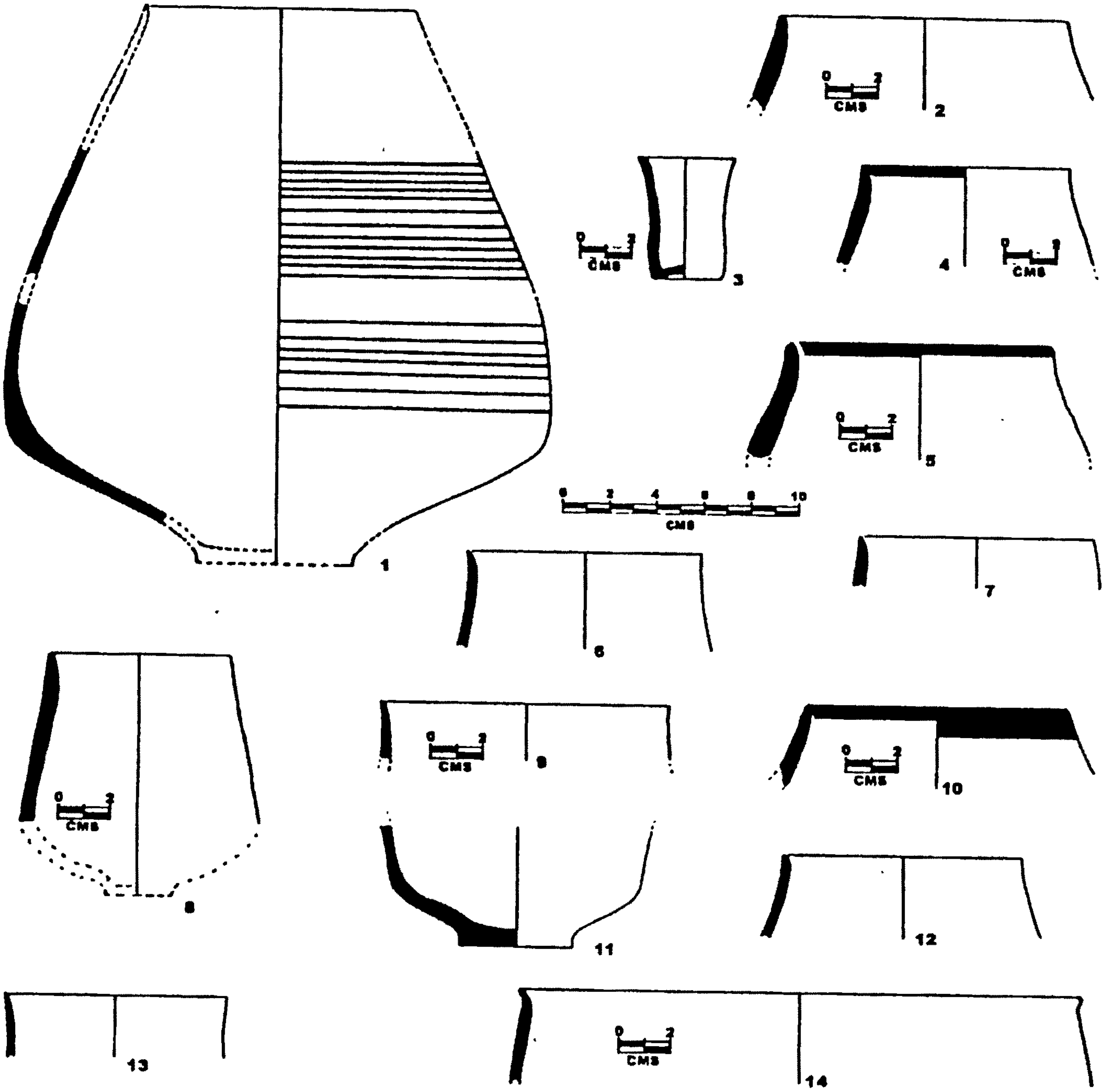

Fig. 8: Early Harappan Beakers from North Gujarat

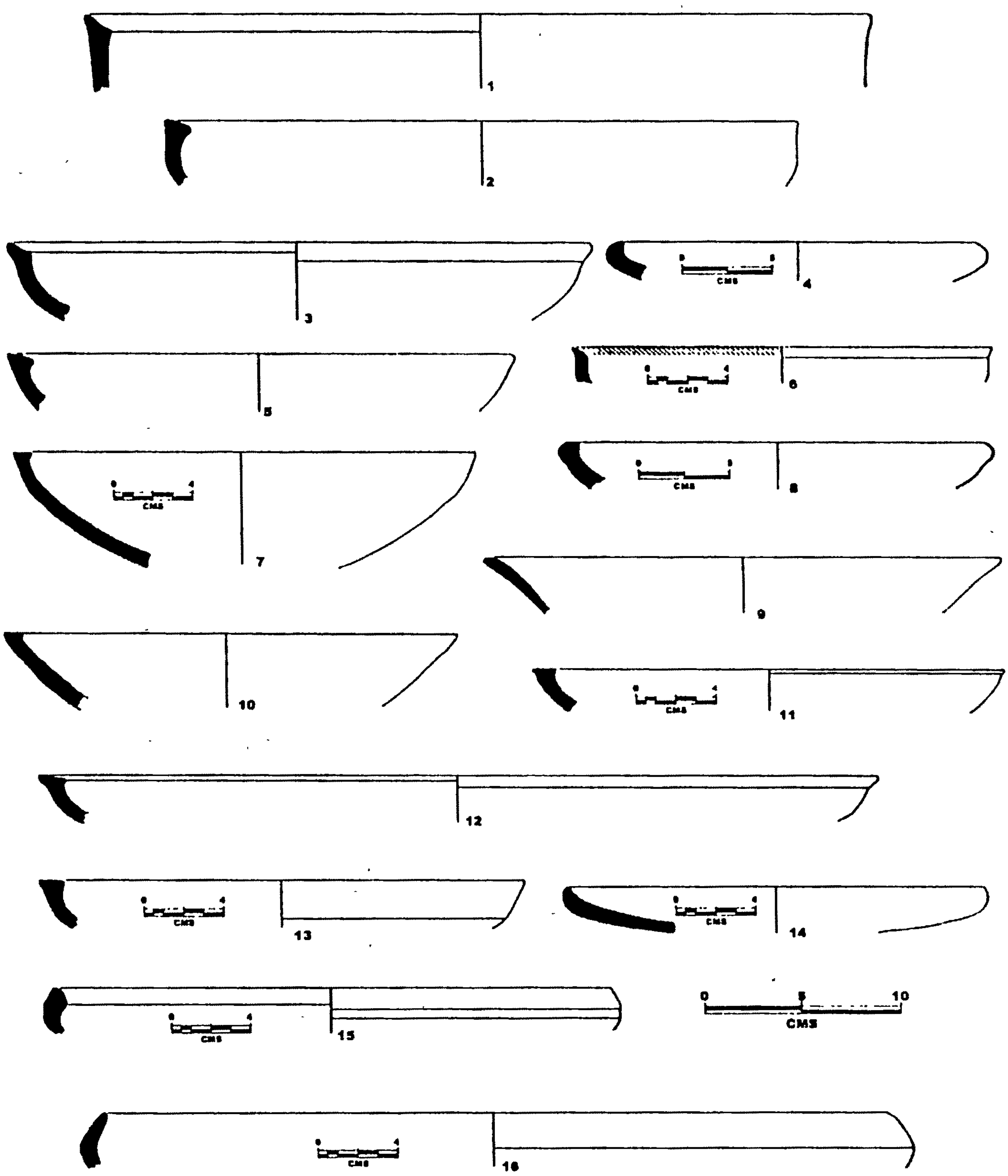

Fig. 9: Early Harappan Dishes and Bowls from North Gujarat

The Red ware and the Buff ware vessels are painted in black and different shades of red pigment, which ranged from bright red to dark brown, at the rim, neck and shoulder. The use of white pigment for decoration can also be seen. Designs painted over the pots are generally a thick band at the rim and series of parallel, horizontal lines or

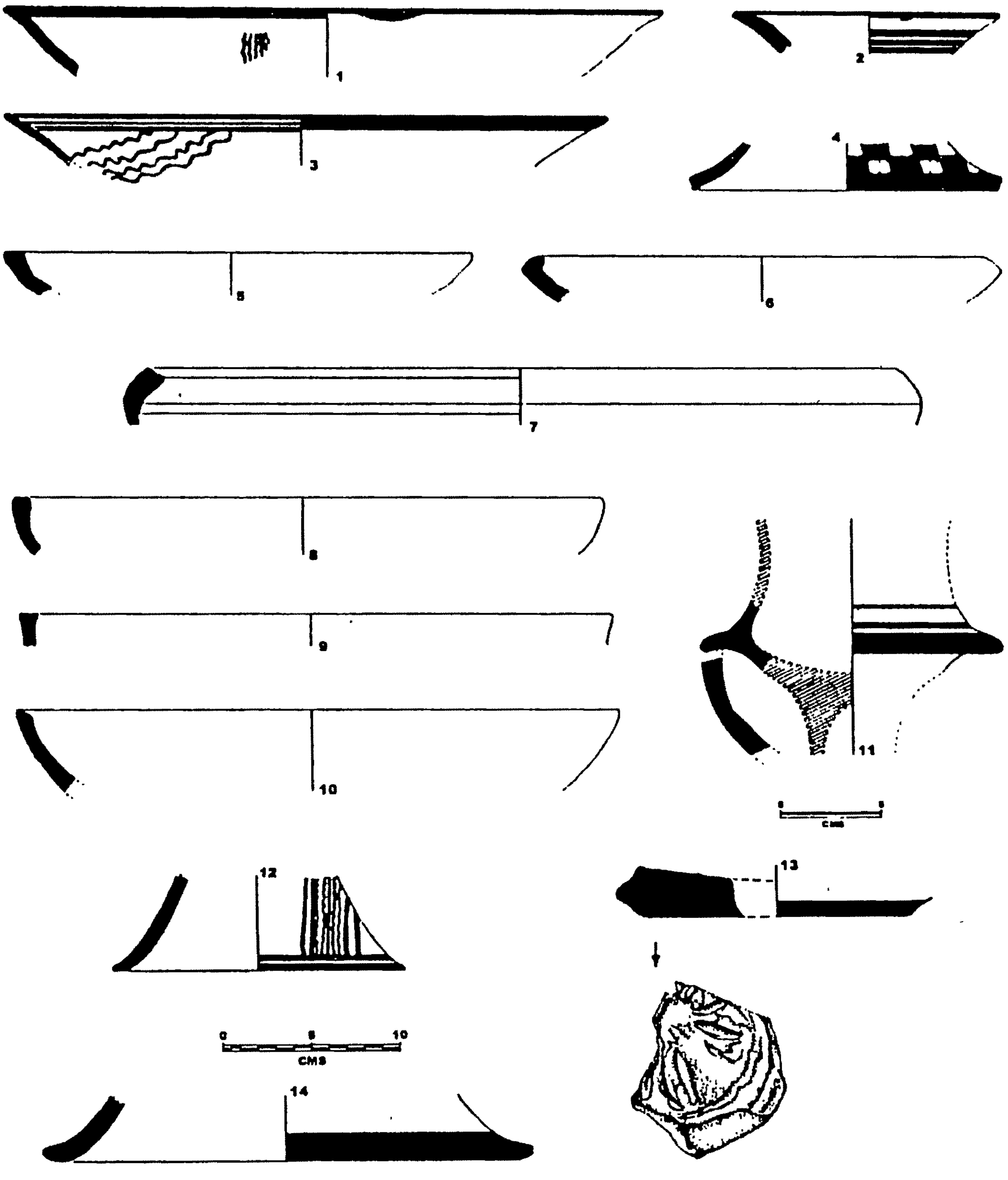

Fig. 10: Early Harappan Dishes, Bowls and Pedestal Vessels from North Gujarat

wavy lines at the neck, shoulder and body part (Fig. 12). Other paintings executed on the vessels are a series of hanging and intersecting loops or festoons, hatched triangles and leaf, intersecting festoons with set of vertical strokes and semi-circles with two sets of oblique strokes. The decorations are generally confined to the rim, neck

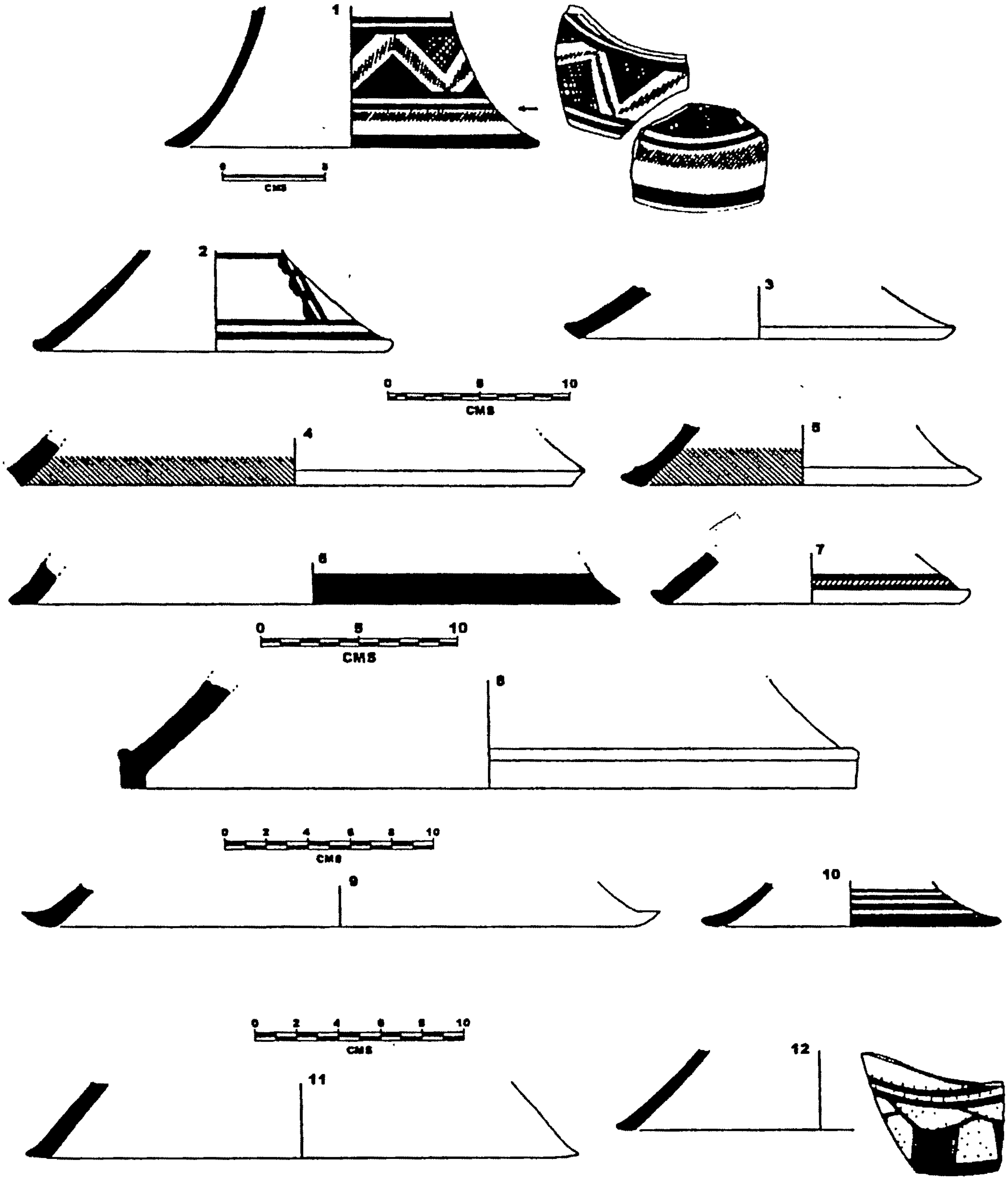

Fig. 11: Early Harappan Pedestal Vessel Forms from North Gujarat

and shoulder part of the vessels, though it sometimes extends up to the body part also. In some of the dish-on-stands in Fine Red ware, red and black pigments were used against a cream background thereby imparting a polychrome effect. The designs in the polychrome ware includes alternating upward and downward hatched

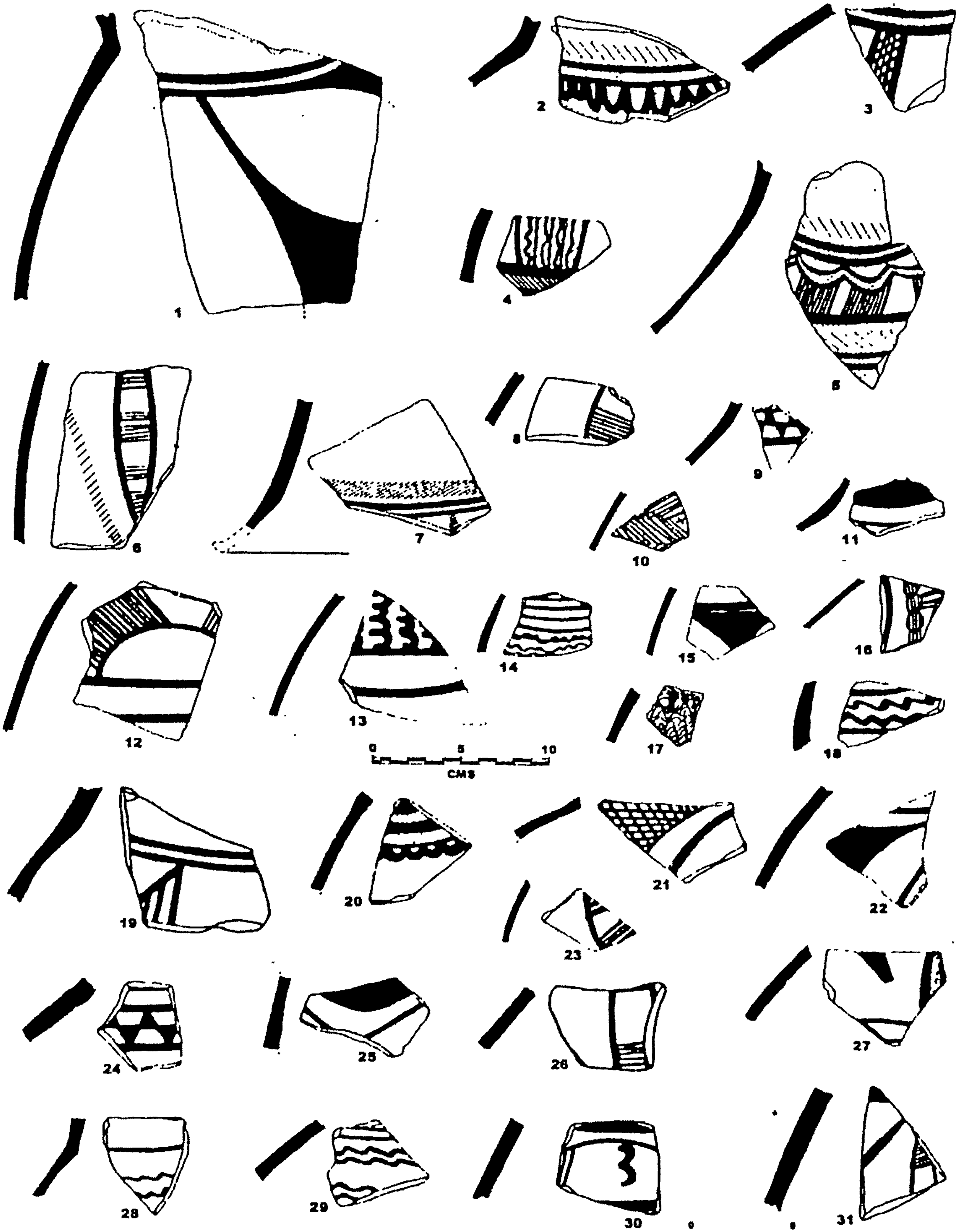

Fig. 12: Early Harappan Painted Motifs on Ceramic from North Gujarat

triangles bordered with parallel horizontal lines and parallel loops with hanging oblique strokes attached to the loops, bordering on top with parallel horizontal lines and on the bottom with a thick band.

Characteristics of the Early Harappans in North Gujarat

The Early Harappan assemblage in North Gujarat is mainly represented by ceramics, along with a few other artefacts. The ceramic assemblage exhibits an amalgamation of Early Harappan cultural traits of various region. The ceramic features from North Gujarat are analogous to the Kot Dijian and Sothi pottery. The vessel shapes, broad band at the neck, loops at the shoulder etc. all show Kot Dijian features, while the bowls with everted rim and the use of white pigment for decoration show an Sothi influence.

Apart from this, some features of Amri, Nal and Balakotian pottery are also seen here. This indicates that the Early Harappan accumulated various traits by the time they arrived in the region of North Gujarat. It is possible that the movement of the Early Harappans into this region was during later part of this phase, at the time, when different traits were beginning to conglomerate and emerge as a single/uniform culture. It might also be possible that the people before moving into this region were exposed to different groups and adopted a few traits from each of these groups.

Early Harappan Migration

Now the question arises as to which route did the Harappans pursue to reach North Gujarat and from where did they migrate. Towards the west of North Gujarat, the furthermost settlement with an Early Harappan assemblage is Surkotada. However, the Early Harappan ceramics have been found mainly from the burials and only a few from the habitation level. Dholavira gives evidence of Early Harappan ceramics, but in a very insignificant amount, and is dominated by an indigenous pre/non-Harappan pottery. Towards north, the Early Harappan settlement in North Gujarat extends upto Suneth, bordering the Great Rann of Kachch. Sites on the southeastern Sind have been located upto Gharo Biro and Kot Khori (Khan 1981). These sites have an Early Harappan/Kot Dijian occupational deposit. Possibilities are that the Early Harappans might have traveled southeastwards from Sind crossing the Rann into North Gujarat.

Recently, Vasant Shinde (personal communication) of the Deccan College, Pune, explored the area south of Kalibangan along the dried bed of River Saraswati. He located a few sites yielding ceramic assemblage similar to those found from North Gujarat. Therefore, another probability is that the people from Rajasthan might have moved further southward towards North Gujarat. Neither possibility can be discounted until further exploration is carried out in these areas.

Early Harappan Chronology of North Gujarat

The time bracket for the movement of the Early Harappans into the region of North Gujarat is still surrounded with uncertainty. At present, there are no radiocarbon dates available for the Early Harappan phase from any of the excavated sites in North Gujarat. However, at most of the sites, this group of ceramic is associated with Anarta pottery. The Anarta tradition is dated to as early as second half of the fourth millennium B.C from Loteshwar (Sonawane and Ajithprasad 1994: 136). Moti Pipli gave evidence of Early Harappan pottery in association with Anarta pottery and a few artefacts of Mature Harappan phase which might have just started appearing. At the site of Moti Pipli, the existence of Early Harappan ceramics can be dated to just before the transformation of the Harappan culture into a Mature phase or to the transitional phase between the Early and the Mature Harappan phases.

At Nagwada, the burials with Early Harappan pottery have been found within the habitation area dug into the natural soil and probably belonged to layer 5 occupation (Hegde *et al.*1988). No habitation deposit of the Early Harappans have been found from the site. The lowest level of occupation is dominated by Anarta pottery, though Harappan ceramic is also present at this level. While at Datrana IV, this group of ceramic has been found at the fag end of the Chalcolithic occupation, which is dominated by pre-Prabhas ceramic (Ajithprasad 1998). The pre-Prabhas culture at Prabhas Patan (Somnath) has been dated to *circa* 3000-2800 B.C (Dhavalikar and Possehl 1992: 72-73).

Reviewing the burials from Surkotada, Possehl (1997: 84) states that ... the remains indicate that they (the burials) are probably a part of the Early Harappan, or the Early/Mature Harappan Transition of Kachch. In the same review, however, Possehl remarks that while the pottery from Surkotada cemetery is Early Harappan in style, it does not necessarily follow that it dates to the time prior to the advent of the Mature Harappan phase. The burials have been designated to Surkotada IA, though they have not been stratigraphically correlated. Although a few sherds of Early Harappan ceramics were reported from the early levels of the habitation at Surkotada, the contexts were not properly described. It is possible that the earliest phase will fall within the time-bracket of the Early-Mature Transitional phase to which these burials belonged. Thus, the present evidence from Nagwada, Moti Pipli, Datrana and Surkotada suggest a time bracket of 2800 to 2550 B.C for the penetration of Early Harappans into Kachch and North Gujarat.

Conclusions

From the above discussion it becomes fairly clear that the pastoral people within the Early Harappan community were the ones who dared to embark on journey to an area hitherto unknown to the Harappans. Their need was to look for new pasture for their ever-growing herds and to ease the pressure on the existing grasslands. Kachch and North Gujarat, with good grasslands, proved an excellent area for their migration. The availability of a few raw materials for their varied industries might have provided an added incentive to Harappans to seasonally migrate in this region.

The Harappans even in their early phase of development have spread in varied ecological regions. A large number of settlements are seen in Sind and Rajasthan which suggests that the Early Harappan pastoralists might have traveled further south and south-east into Gujarat during the first half of the third millennium B.C.

Present evidence indicates that the Early Harappans did not move further south of North Gujarat. Nagwada is the southern most settlement of this phase from where the evidence of Early Harappan cultural markers have been found. However, recent exploration in Junagadh District of Saurashtra has yielded a few sherds definitely belonging to the Early Harappan phase from one of the settlements (Kalini Khandwalla: personal communication). This is a fair beginning and future research in this line will definitely bring forth interesting results. The presence of the Early Harappans in Saurashtra, if established, will show that they penetrated as extensive an area, at least in Gujarat, as their illustrious successors, the Mature Harappans.

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Fishing Practices among the Mallahs of Allahabad District, Uttar Pradesh*

Shahida Ansari

Department of Archaeology
Deccan College
Pune 411006

Abstract

This is an ethnographic study of fishing practices among the Mallahs of Allahabad district, Uttar Pradesh. The paper attempts to correlate the ethnographic data with archaeological evidence from the Ganga Valley. The ethnographic data provides a better interpretation of the fish remains from archaeological sites, the role played by fish in prehistoric diet, the techniques involved in fishing, types of fishing tools and likely residues which would remain after processing. Mallah settlements were also studied to understand the importance of temporary, seasonal and permanent settlements in the context of bone disposal.

Introduction

Beginning in 1995 the author has carried out extensive ethnographic fieldwork among the primitive communities (Musahars, Kols and Mallahs) of Allahabad district, Uttar Pradesh. Observations made on small game hunting practices among the Musahars have been documented earlier (Ansari 1999-2000: 142-150). The fishing practices among the Mallahs and Musahars of Allahabad District are discussed here.

Rapid destruction of forests and the segmentation of forestlands by roads, buildings, factories and agriculture have severely reduced the natural habitat of big game. However the tradition of small game hunting, though of little economic importance, is still practised among the primitive communities inhabiting this area.

Hunting and fishing were the main sources of subsistence for the Mesolithic inhabitants of the Ganga Valley. The area has rich resources of wild fauna and aquatic animals. Human groups have lived in this fertile region since the Mesolithic, as hunter-gatherers and in the Neolithic and Chalcolithic and Iron Age, as settled inhabitants.

Fishing Practices among the Mallahs

The word **Mallah** is a generic term used for a group of people whose occupation revolves around water transport and fishing. In the study area they are also known as *Nishad, Kewat, Dhimar, Karbak, Kachhwaha* or *Jalak*. According to Russell and Hirallal (1916: 171-72) the word Mallah is an Arabic word meaning 'salt' or, according to a general term as 'to move its wings as a bird'. The term is no doubt purely occupational, and, being of Arabic origin, must have been introduced in comparatively recent times. Today in addition to selling sell fish in the market some of them are employed in rickshaw-pulling, agriculture and as daily-wage labourers (Singh 1993: 899).

Fishing plays an important role in their lives, as fish are an important part of their diet. Fishing and hunting were two of the most important occupations of the early humans so the importance of the ethnographic data related to this occupations cannot be overestimated. The quest for food has contributed much towards the cultural development of man over time.

The rivers and lakes in the study area contain an abundance of different varieties of fish. The Mallahs live along rivers and lakes, and have an expert knowledge of the habits of the different varieties of fish found in the area. In the study area Mallahs, and to an extent Musahars, have developed fishing into a highly effective technique of subsistence. However, only a few Mallahs make their living solely by fishing. The aquatic food has an exceptionally high degree of nutritional value. Characteristically fish is rich in fat, vitamins, calcium, phosphorus, iodine, and common salt and most of these food values are also retained in the fish, which are sun dried and consumed later.

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Species Exploited (Table 1)

The Mallahs and the Musahars have local terms for the fish caught by them in the rivers Ganga, Yamuna, Tons and their tributaries, as well as lakes, canals and ponds. The author collected the local names. The scientific names were collected from relevant literature (Bilgrami 1991: 87-89; Jhingran 1983: 5-66, 98).

In the Yamuna prawns, locally known as *jhinga*, (*Macrobrachium malcolmsonii* and *Palaemon lamarrei*) are also caught. The local names for the fish exploited from river Tons are; *Anduwar, Baikari, Bmia, Banni, Bhakur* or *Katla, Bhur, Botha, Chalhwa, Chelhwa, Charkhi, Cheena, China, Chitra, Darha, Gegra, Genth, Gonch, Grasskar, Hilsa, Jhekwa, Kaonchi, Kanhva, Kari, Karyee, Khutwa, Kohwa, Kusuma, Lahki, Latur, Mahaser, Maila, Mangur* or *Manguri, Moi, Nain or Mirgul, Negri, Pahina, Pamflet, Pariyar, Pathari, Petwari, Phulahi, Rohu, Sandhi, Sechaki, Sethia, Silver, Sindha, Singhi, Sorahu, Souur, Suies* and *Tengra.*

The common bony fish are carp (Osteoglossiformes, Cypriniformes) and catfish (Siluriformes). Scales are present in carp, while catfish are scaleless. The *rohu* (*Labeo Rohita*) is the most famous variety of carp. This fish, when full grown, attains a length of 0.90m. The other variety of carp, *mirka*, (*Crrihinus mrigala*), which resembles *rohu*, is the most famous fish found in the Yamuna river. When full grown it attains a length of 0.66 m. The largest variety of carp caught by them is *catla* (*Catla catla*), which is about 1 m to 1.15 m long. The lengthy catfish caught are *boari* (*Wallago attu*), which is 0.90 m long, *aria* (*Mystus seenghala*), which is 1.20 m long, and *ritha* (*Rita rita*), which is 0.75 to 1m long.

Methods and Techniques of Fishing

Riverine fishing

Fishing is a year round activity. In the rains the pace of fishing is more hectic, for then some economically important varieties of fish, like *rohu* and *hilsa* are found in abundance. In deep river water, fishing is done from boats using nets. During the summer the rivers shrink and change into shallow streams and pools. Then the method of fishing is restricted to using traps and small nets.

According to a local Mallah, Mishrilal, 'Fishing starts at dawn with the Mallahs sitting in their *dongis* (small, long and narrow boats, prepared from a single thick tree trunk). They enter the river with a *sarhat* (fishing instrument with 12 pointed iron prongs), a *kurail* (a big net) and a *bisari* (a small net) for catching fish'.

Lacustrine fishing

Fishing is also carried out in *jhils* and tanks, which are the breeding grounds of many fresh water fish. Innumerable tanks are scattered throughout the study area. Fish are caught with nets and traps. In large tanks fishing is done with nets, hooks and prongs. In small tanks fishing is done in summer when the water is shallow. Fish are then caught by hand, sticks, and cover baskets.

Paddy field fishing

The paddy fields, which retain water for two to three months, provide an additional supply of fish. Fishing is carried out in the rainy season, in small pools in rice fields with baskets, hooks and by hand. Eight types of fishing techniques are used in the paddy fields:

(a) Fence/Screen fishing

Fence or screen fishing is carried out in rivers or streams, where there is a strong current and the water is not deep.

(i) *Chilwan* (Fig. 1) is the screen made of bamboo splinters held together by strings twined along the upper and lower margins as well as at regular intervals in between. It is about 3 to 4.5 m long and 1.20 to 1.50 m wide. These screens are placed as barriers across small streams. In *jhils*, the shallow pockets are enclosed with screens for fishing. These areas are also subdivided into small compartments by erecting low earthen bunds. The screened area is then emptied, by bailing out the water, and the fish remaining behind are caught by hand.

(ii) *Chinta* is a screen made of *narkul* (*Phragmites karka* Trin. ex Steud.) or with bamboo strips. One screen is placed vertically and the other horizontally (Fig. 2). Both the screen corners are tied together with the help of rope made from *sanai*, i.e. hemp (*Crotalaria juncea* Linn.) and placed in shallow water (Fig. 2). When water passes through small pores of the screens, fish are stranded on the bottom of the shallow pools. Later they are caught by hand. Generally children use this technique to fish in the rainy season. In *jhils* this screen is used to cut off a large shallow area. The enclosed space is divided into small

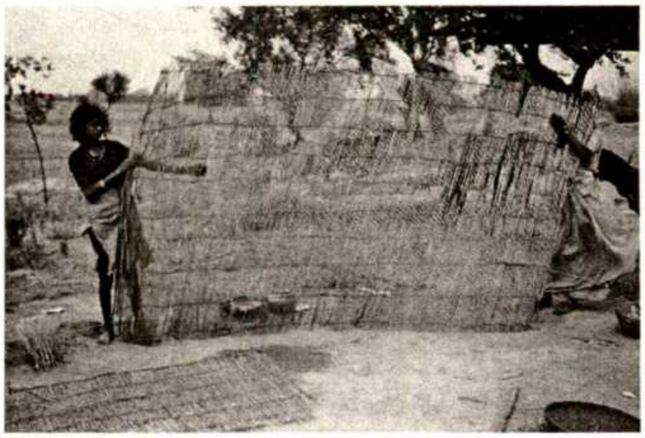


Fig. 1: Mallah women showing *Chilwan*

Table 1: List of fish exploited by the Mallahs and the Musahars from the Rivers Ganga and Yamuna.

Order	Family	Species	Ganga	Yamuna	Local Name
Osteoglossiformes	Notopteridae	*Notopterus chitala* (Hamilton)	+	+	*Moi, Chital*
		Notopterus notopterus (Pallas)	+	-	*Moi*
Squaliformes	Dasyatidae	*Dasyatis pastinacus* (Linnaeus)	-	+	
		Dasyatis sephen (Forsskal)	-	+	
Clupeiformes	Clupeidae	*Hilsa ilisha* (Hamilton)	-	+	*Ilish, Sunri*
		Gudusia chapra (Hamilton)	-	+	*Chapri*
		Setipinna phasa (Hamilton)	-	+	*Phasa*
Atheriniformes	Belonidae	*Xenentodon cancila* (Hamilton)	+	-	*Kaua*
Perciformes	Centropomidae	*Chanda nama* (Hamilton)	+	-	*Chanda*
		Chanda ranga (Hamilton)	+	-	*Chani*
	Mugilidae	*Rhinomugli corsula* (Hamilton)	+	-	*Aruari*
	Gobiidae	*Glossogobius giuris* (Hamilton)	+	-	*Bulla*
	Channidae	*Channa punctatus* (Hamilton)	+	-	*Garai*
		Channa stratus (Bloch)	+	-	*Soura*
	Mastacembeliadae	*Mastacembelus annatus* (Lacep)	+	-	*Gainhi*
		Mastacembelus pancalus (Hamilton)	+	-	*Patgainchi*
Cypriniformes	Cyprinidae	*Cirrhinus mrigala* (Hamilton)	-	+	*Mirka, Nain*
		Cirrhinus reba (Hamilton)	-	+	*Reba, Raiya*
		Chela laubuca (Hamilton)	+	-	*Chelhawa*
		Chela atpar (Hamilton)	+	-	*Chelwa*
		Securicula gora (Hamilton)	+	-	*Darialchalo*
		Salmostoma bacaila (Hamilton)	+	-	*Chelwa*
		Salmostoma untrahi (Hamilton)	+	-	*Chelwa*
		Aspidoparia morar (Hamilton)	+	+	*Harda*
		Aspidoparia jaya (Hamilton)	+	-	*Dhawai*
		Amblypharyngodon mola (Hamilton)	+	-	*Dhawai*
		Puntius chola (Hamilton)	+	-	*Pothia*
		Puntius chrysopterus (McClelland)	+	-	*Pothia*
		Puntius sophore (Hamilton)	+	-	*Pothia*
		Puntius ticto (Hamilton)	+	-	*Pothia*
		Osteobrama cotio (Hamilton)	+	+	*Guda*
		Labeo bata (Hamilton)	+	-	*Bata*
		Labeo dero (Hamilton)	+	+	
		Labeo calbasu (Hamilton)	+	+	*Calbasu, Karounch*

Order	Family	Species	Ganga	Yamuna	Local Name
		Labeo rohita (Hamilton)	+	-	*Rohu*
		Catla catla (Hamilton)	+	-	*Catla, Bhakur*
Siluriformes	Bagridae	*Mystus aor* (Hamilton)	+	+	*Aria*
		Mystus bleekeri (Day)	+	-	
Siluriformes	Bagridae	*Mystus cavasius* (Hamilton)	+	-	*Tengra*
		Mystus seenghala (Sykes)	+	+	*Aria*
		Mystus vittatus (Bloch)	+	-	*Tengra*
		Rita rita (Hamilton)	+	+	*Ritha*
	Siluridae	*Ompok bimaculatus* (Bloch)	+	-	*Jalkapoor*
		Wallago attu (Schneider)	+	+	*Boari*
	Schilbeidae	*Ailia coila* (Hamilton)	+	+	*Banspatta*
		Chupisoma garua (Hamilton)	+	+	*Garua*
		Eutropichthys vacha (Hamilton)	+	-	*Bachwa*
		Pseudeutropius atherinoides (Bloch)	+	-	*Barusa*
		Silonia silondia (Hamilton)	-	+	*Sitan*
	Pangasiidae	*Pangasius pangasius* (Hamilton)	-	+	*Pangus*
	Sisoridae	*Bagarius bagarius* (Hamilton)	+	+	*Bagari*
		Nangra punctata (Hamilton)	+	-	*Panhi*
		Sisor rabdophorus (Hamilton)	+	-	

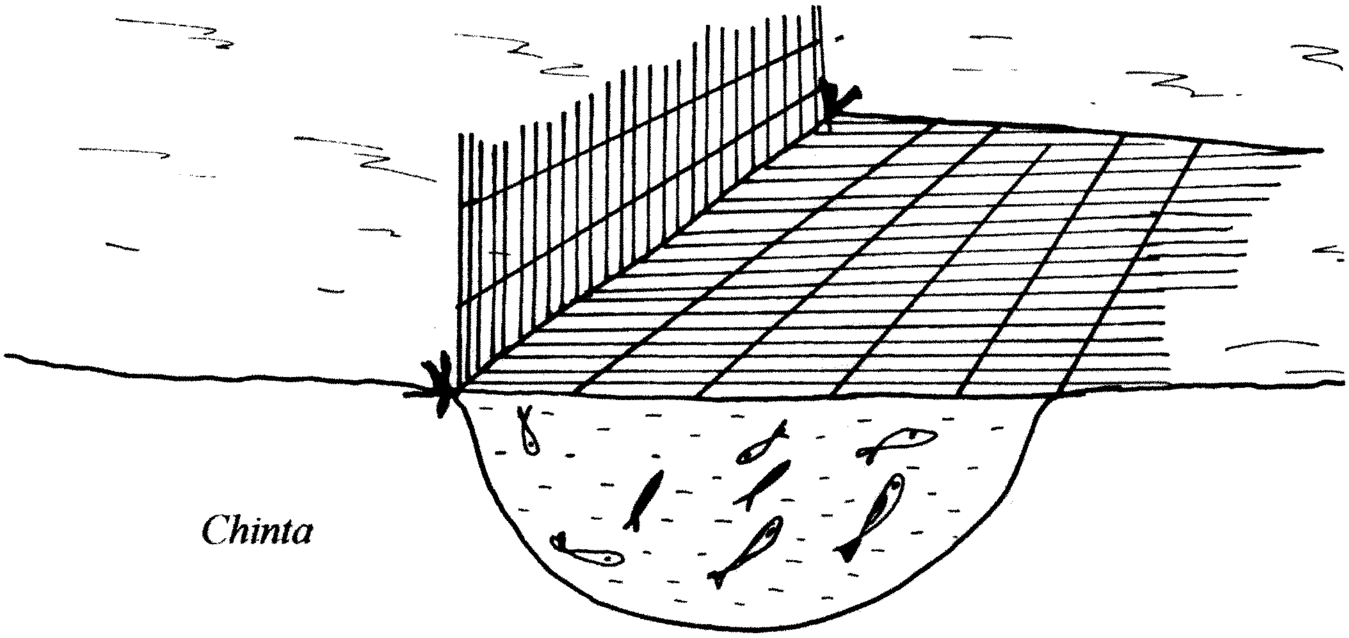


Fig. 2: *Chinta* in shallow water

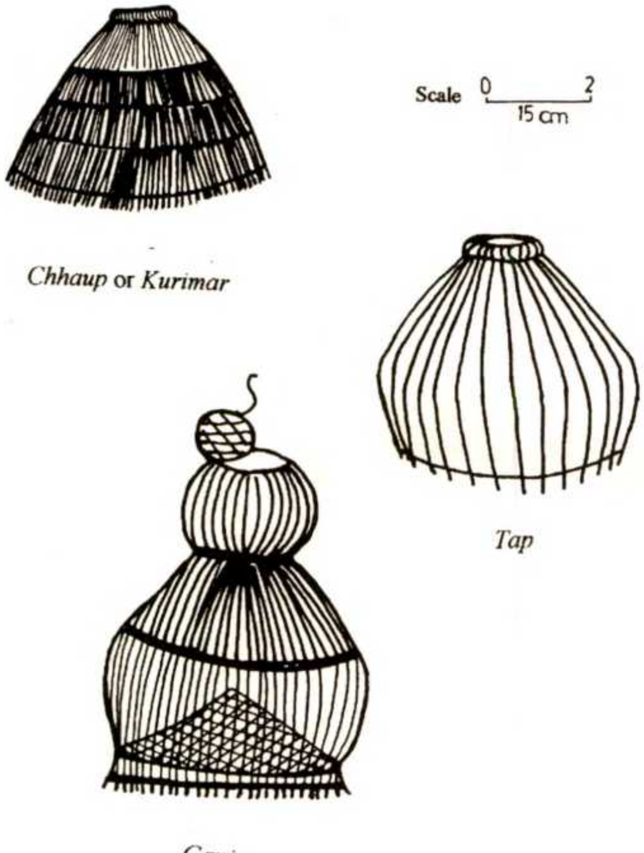
enclosures by throwing up earthen bunds. Each enclosure in turn is emptied by bailing the water out until the fish are stranded and can be easily picked by hand.

(b) Fishing with traps

Traps and baskets of many kinds are used for fishing especially in shallow tanks, fields inundated by rain and in shallow waters. Traps have an entrance where fish enter and get trapped. Traps of different sizes are used for catching fish of different sizes.

The most primitive method adopted for trapping fish is to lay down bushes and branches in tanks or ponds in the rainy season. When the water level goes down after the rainy season, fish seek shelter in the depression. Fishermen remove the branches and catch the fish by hand.

(i) *Tap* is a trap made of bamboo strips tied together with a rope made of hemp (Fig. 3). It has two openings; the upper end is smaller in size than the lower one. This is effectively used in shallow water, not exceeding 60 cm in depth and is generally carried out by women and children. The process to operate the trap is to walk step by step in the opposite direction to the flow of the stream. The fish are caught inside the *tap*, when the lower opening is pressed on the riverbed. They are then removed through the upper opening.



Chhaup or *Kurimar*

Tap

Ganja

Fig. 3: Types of traps

(ii) *Chhaup or Kurimar* is a bottomless, conical basket trap (Fig. 3). It is mostly used in summer in shallow waters, with muddy bottoms preferably not more than 40 cm deep. The *chhaup* is jabbed down over the fish. The entrapped fish are caught by inserting the arm through the narrow upper opening. This trap is also used for catching frogs, which are used as bait. Some fishermen stand in a semi-circle in a vast stretch of water, while others disturb the surrounding water by hitting the surface with sticks to drive the fish towards the men waiting in a semicircle. The fish are then jabbed and collected.

(iii) *Ganja* is a trap made of thin bamboo strips, which are held together with rope at three places. This trap, which resembles a dome, has a round opening at the lower end and a valve in the middle (Fig. 3). The upper end has a small opening, which is covered with a lid and tied with rope. The trap is placed against the flow of the stream in such a way that the water passes through it and entraps fish inside it. When the trap is lifted up, the water drains through the valve while the fish remain entrapped. Narrow-necked earthen jars are kept on the bottom of tanks creating tempting hiding places for burrowing fish like *singhi* (*Saccobranchu fossilis*) and *mangur* (*Clarias magur*).

(c) Fishing with nets

Fishing with nets (*jal*) is practised in rivers, lakes, open waters and sluggish streams. Nets are made of nylon strands. The shape of the net is circular or elongated. Different types of nets used by them are:

(i) *Bhawar jal* is a circular net weighed down at the edges by net sinkers and has a string attached to the centre. For casting, the net is rotated in the air to open it and then thrown onto the surface of the water (Fig. 4). Immediately the weight of the sinkers pulls the edges down to the bottom. Fish get entangled within the net in the circle

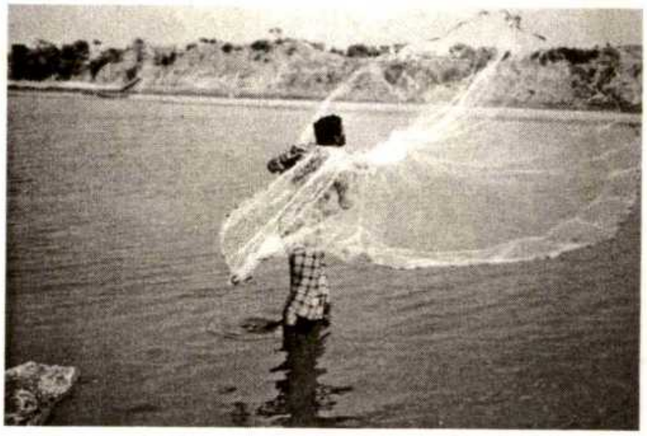
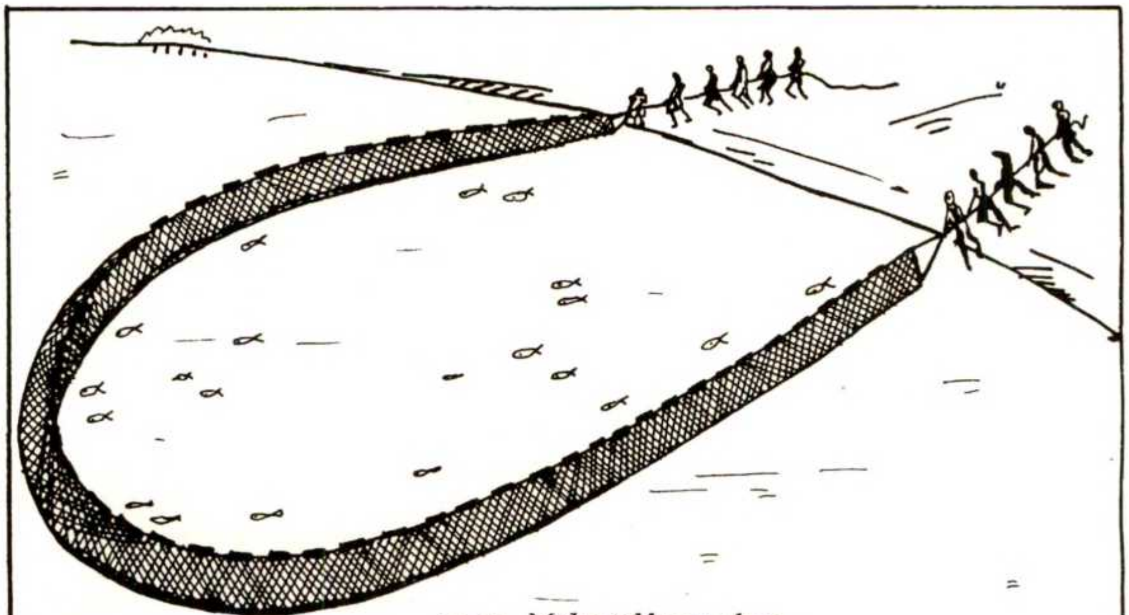
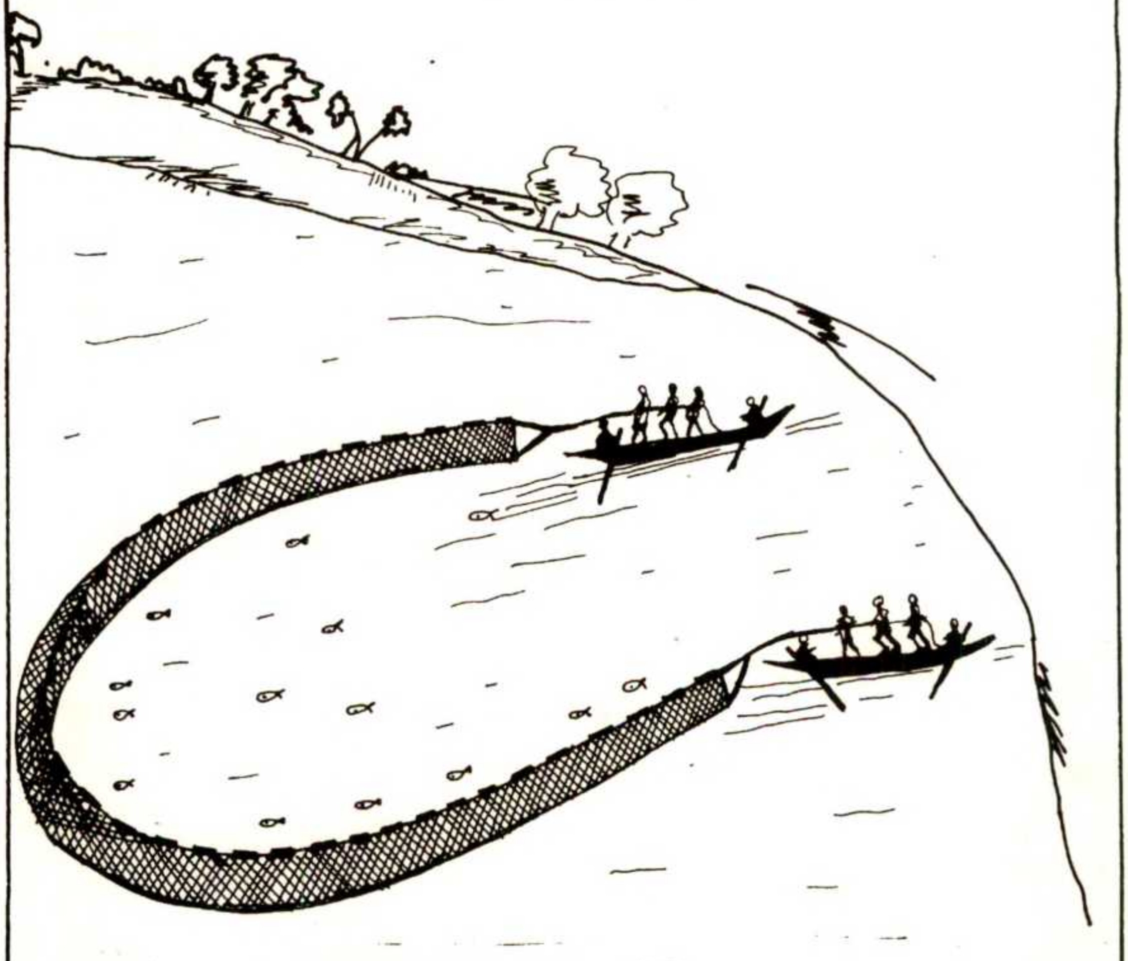


Fig. 4: A Mallah fishing with *Bhawar jal*



a: *Maha jal* by *wading*



b: *Maha jal* by *boat*

Fig. 5: Fishing with *Maha jal*

formed by the sinkers. The centre string is then pulled which results in the net shutting like an umbrella with the fish trapped inside. The net is pulled onto the bank and the fish removed by hand.

(ii) *Maha (kurail/ santa/ ber jal)* is a large-sized net, operated with boats (*dongis*) or by wading (Fig. 5a, 5b). The net is 40 to 60 m long. The mesh varies from 0.5 to 4 cm. It is made of hemp and nylon string. When operated from boats the net is loaded on two or more boats. The boats move away from each other spreading the net across the water. Then the boats are rowed with equal speed to the riverbank in a semi-circle by hauling the ropes, attached at the ends of the net. This is also done by wading by six to ten men tailing on to each end of two long hauling ropes towards the bank in a semicircle trapping the fish in between (Fig. 5a). This technique is used both in rivers and lakes.

(iii) *Bisri or chhot-ber jal* are small variety of nets used for fishing.

(iv) *Fasila jal* is a net used by the Kols for trapping fish. It is a fine, thin variety of nylon net, which is used in the river.

In earlier days the nets were made of hemp and silk thread. Now they are made of nylon thread, cotton and hemp thread. The nets are made locally. Net sinkers are made of terracotta, stone, potsherds and brick fragments.

The tanning of nets and baskets is done with pulped fruits of *kalatendu* (*Diospyros peregrina* (Gaertn Gurke), which is a good preservative. To prepare the tan, ripe fruit is boiled in water and kept for several days in an earthen jar till it decomposes to a brown gummy fluid. This fluid is then applied on the net and baskets.

(d) Fishing with hooks and lines

The hooks are simple and perfect fishing tools. The Mallahs earlier used thorn, wood or bone hooks, which have now been replaced by iron. This technique is followed in all types of water sources. The most primitive method of fishing is using the thorn hook, which is tied to hemp string.

(i) The hook i.e. *Katia* is a rounded iron object pointed at the curved end. One end of the string is tied to the hook and the other to a long bamboo stick. A small cylindrical piece of wood i.e. *bulla* tied to the hook with the help of thread works as a float (Fig. 6). While fishing, the bait used is earthworm, grasshopper, snail or dough of flour, i.e. *atta* which is attached on the point of the hook and dropped into the water. As soon as the fish comes to take the bait, its mouth gets impaled on the hook. The fish struggles to free itself leading to the moving of the *bulla* on the water surface. This movement is an indication of the bait being taken and the person holding the stick withdraws the string from the water. Hooks of different sizes are used to catch different varieties of fish.

(ii) The Mallahs also make aromatic clay balls as bait. The balls are a ground mixture of seeds of black gram, lentils, hemp leaves, mustard, *akanji* (*Kaemferia galanga* Linn.), *tejpatta* (*Cinnamomum tamala* Nees and Eberm.) and *ghorboch* (*Acorus calamus*). This mixture is added to a paste of rice, ghee (clarified butter) and black clay. Another mixture is made of cinnamon bark, mustard seeds and fenugreek seeds, stiff black clay and rice paste. The fishermen use small mice, cockroaches and small dried fish as bait.

(iii) *Katia jor or baited pole*: Small fish are kept in a vessel to decompose and are used as bait when they start emitting a foul smell. The hooks with baits are tied at the ends of long cords. About three to four sets of these hook cords are tied at equal spaces to a long thick cord, which is tied to a bamboo pole (Fig. 7). These poles are fixed in the water in such a way that they project 50 to 70 cm above the water level. The floats are tied to the hook cords with string. The foul smell of the bait attracts fish in large numbers and they come to feed on the bait. This movement of the floats (*bulla*) is a signal to the fisherman that the fish have come to feed. He approaches the spot quietly through the water and throws a net and collects the fish.

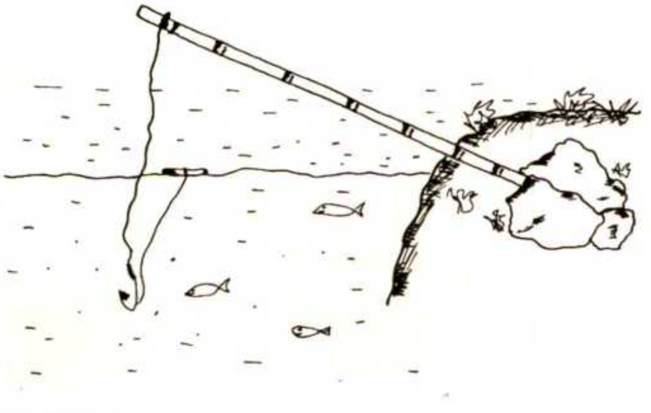


Fig. 6: *Katia*

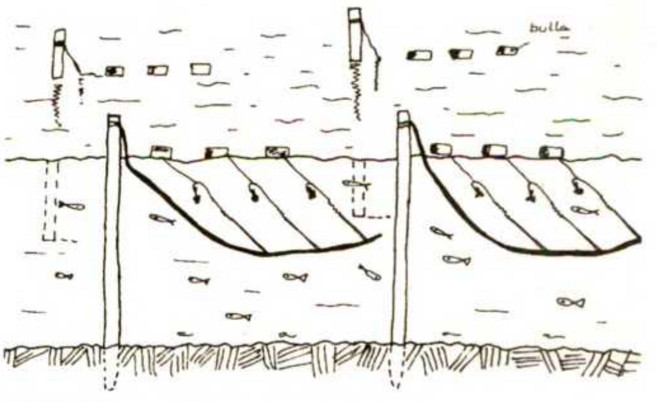


Fig. 7: Fishing with *Katia-jor* or baited pole

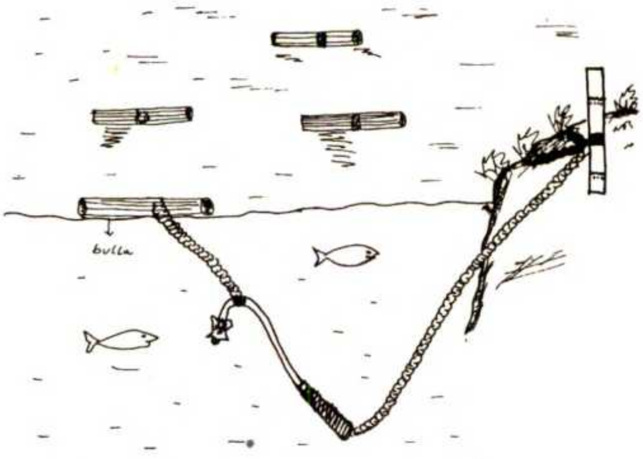


Fig. 8: *Barra*

(iv) *Barra***:** This snare consists of a cylindrical float made by joining of *narkul* (*Phragmites karka* Trin. ex Steud.) strands (Fig. 8). The middle of the float is tied to a cord. The other end of the cord has a flexible bamboo splint (the two ends are bent till they nearly meet and are placed delicately inside the body of bait) is tied to the bait frogs, snails or grasshoppers. When the fish tries to seize the bait, the bent splint springs apart within the mouth of the fish resulting in its entrapment. In some cases the fish takes the bait in the mouth and pulls it till the string snaps and it swims away dragging the bait and floating *bulla*. By allowing the *bulla* to float on the surface the fish feels less pain from the splint than by trying to pull it down under the water. The struggle gradually weakens and the fish succumbs in the end. The fisherman follows the float and pulls the string trailing under to collect the fish. A number of such floats are set in the evening in paddy fields and the fish are collected the next morning.

(v) Ballum or Pachki is a pronged spear (Fig. 9). It is made of iron (14 cm long) and hafted into the hollow end of a long bamboo shaft of over 3 m length. The butt is bound with an iron ring or by a cord or fibre. It is a heavy weapon and requires considerable strength to hurl. It is generally thrown by a man standing on the prow of a boat, and sometimes from the bank of a stream or from shallow water (Fig. 10). A single prong is used principally in the pursuit of large fish and tortoises. For other types of fish the number of prongs varies widely, from one to six. The names differ both according to the number of prongs and to the locality but *bullum* is the most common name.

(e) Fishing by sticks and hands

Another fishing method is building a low earthen *bund* between the shallow water and the main water body. The water is bailed out leaving the fish stranded. Some water is left for drying by evaporation, which saves the labour involved in bailing. This technique is for catching small and medium-sized fish. It is followed in *Gadhaye* (pond). Here fishing is productive and large amounts of fish are collected and are distributed equally among villagers. In group fishing the fishermen enter the shallow water or rivers, lakes and ponds with sticks. The Mallahs then form a circle and begin to churn the water with sticks. The fish are stunned and start dying from the blows. They are then collected by hand.

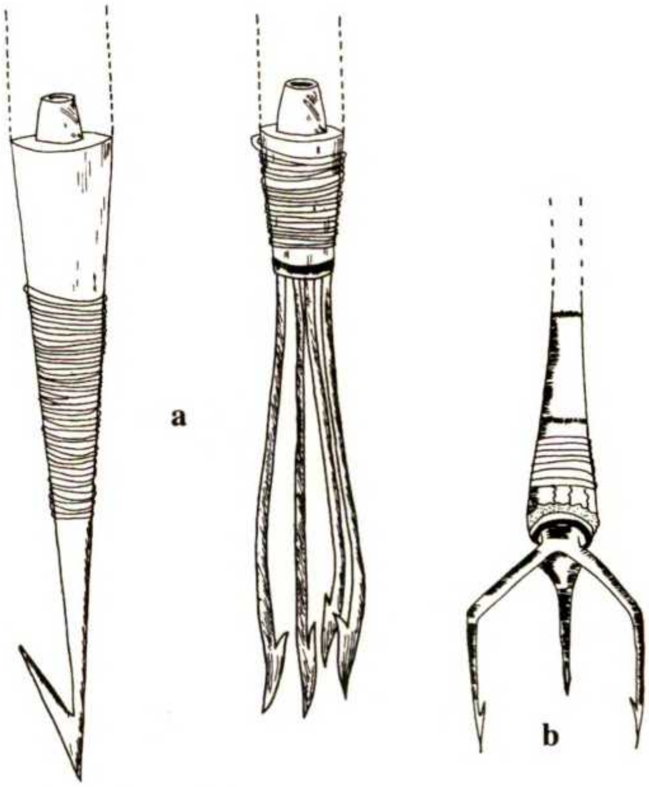


Fig. 9: Types of prongs

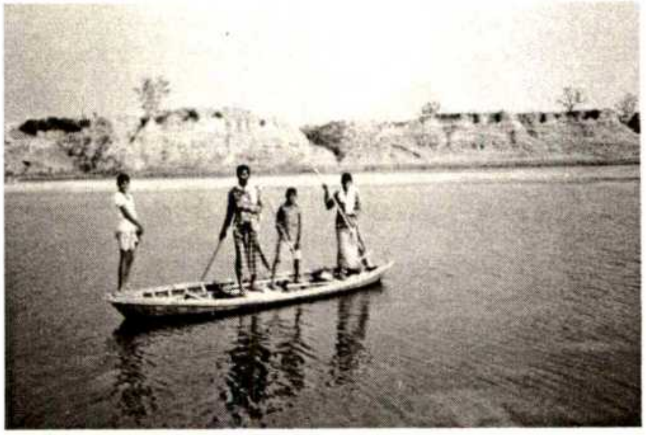


Fig. 10: Mallah men on *dongi* with *Ballum* and *Pachki* (prongs)

(f) Fishing by explosives

In this technique the Mallahs and Musahars use an explosive (*gollar*) and blast it in shallow water. Due to the explosion many fish die immediately. The ones, which survive, are stunned and come to the surface of the water. Meanwhile a group of men barricade the area and collect the startled fish skilfully by hand. Teenagers and children surround the banks and collect the thrown fish. An explosive can kill about 5 to a 100 fish at a time.

(g) Fishing by poison

Fishing by poisoning is a well-known technique among the Mallahs and Musahars. It is a group activity. Many plants contain substances, which are toxic and are adopted as fish poison. The fishermen use seeds of *datura* (*Datura stramonium* Linn.), *gonj* (*Derris scandens* Benth.), *gidar tamaku* (*Verbascum thapsus* Linn.) and latex of *sehund* (*Euphorbia antiquorum* Linn.) as fish poison. The plant, bark or seed is beaten on the rock near the pond and added to the water or sprinkled on the water in powder form. The water is stirred with the help of sticks and feet. The fish become comatose and start floating on the surface of water and are easily caught. Electric current through naked wires is passed in the pond where fish are in abundance. The fish are electrocuted and start floating on the surface of the water, and the fishermen collect them.

(h) Fowling while fishing

This technique of the Musahars and Mallahs for catching birds is a remarkable one. The birds are caught from lakes or ponds (*tal*) at night. Two or more persons sit with a lamp in a boat (*dongi*). One of them holds the brass plate and starts beating it softly which produces a melodious sound to which the birds are attracted. The birds come towards the boat and are easily entrapped by nets thrown over them. *Lalsar, teeka, kaigar, laokura, tehuwa* and *girra* are some of the birds caught from the *tal*. Thus, fishing nets are also used to catch birds.

Besides, the oil lamp in the *dongi* is also lit to attract flies, moths and other insects. They come near the flame, which burns their wings. The burnt wings fall into the stream and float on the water. The fish are attracted to the bits of food floating on the surface and are caught by nets.

The *dongi* is employed for fishing as well as for carrying passengers and goods. While rowing against the current the rower always sits at the fore end of the boat.

Spawn collection

Fish spawn or fish eggs are collected from the fish breeding grounds. Fish eggs are mostly collected from 30 to 60 cm deep meandering rivers, lakes and ponds. The method of collection is by disturbing the bottom of the water and scooping up the eggs with a piece of cloth. Frequently nets of small mesh size are placed against the current and pulled up for the collection of eggs.

In the Ganga fishspawn is collected from May to September. Young and newly hatched fish are collected from July to October. The young fish are generally caught for consumption. *Catla* and *rohu* eggs are collected for breeding and selling. The eggs when brought are stored in especially prepared mud pits. The size of these mud pits ranges from 0.50 to 1.5 m in diameter 0.50 m in depth.

Organisation of labour (Table 2)

Fishing is primarily a male activity but there is no taboo against women taking part in it.

Processing and Preservation

Due to subtropical climate the fish decompose quickly. Heat and moisture promote the deterioration. For this fishermen take adequate precautions. Before processing they keep small fish alive in earthen pots filled with water. Large fish are stored in water collected in a sand enclosure near the lake and river.

Preservation

One of the techniques of preserving fish is to dry them. Sun and wind drying are the common methods employed for drying fish. The other methods employed by the fishermen for preserving the fish for longer periods of time are by dry salting and wet salting.

In the dry salting method, salt powder is rubbed on the fish. Oily fish require more salt. After a day, the fish are washed in salt water and dried in the sun for 15 to 30 days. These fish last for up to a year. In the wet salting method, salt water and turmeric are mixed in a container. The fish are dipped into the containers and left for a day. The next day they are dried in the sun. Wet salting is done for large-sized fish.

Small fish are first washed and cleaned with water to remove slime, blood, mud and sand. They are then dried in the sun. In big and medium-sized fish, the internal organs like viscera are removed and the body cavity is washed and salted before drying.

Fish are dried on the roof of the house, in the open on platforms, on poles, on the ground and on racks. Racks are constructed in such a way that fish get maximum exposure to sunrays. Racks are made according to the size of the fish. To construct a rack, 8 to 10 bamboo splits are planted vertically at a distance of about 30 cm each and 12 to 18 bamboo splits are tied horizontally at a distance of 15 to 20 cm to the vertical posts. A simpler method for hanging half-dried fish consists of two vertical posts supporting another one. Sometimes, instead of bamboo, a rope is tied

Table 2: Division of Labour among the Mallahs

Men	Women	Children
Cut and carry back the bamboo, hemp and munj grass for making the baskets, nets, ropes and shafts.	-	-
Acquire iron hooks, net sinkers and nylon strings from the local market. Help in making baskets and fences.	Make baskets, and ropes for fishing.	Make ropes.
Make and apply tan to the nets, fences and baskets.	Apply tan to baskets and fence.	-
Fish with nets, fences prongs, iron hooks, and by poison and explosion and they row boats.	Hunt with hands and sticks, fences and baskets.	Hunt with hands and sticks, fences and baskets. They row boats.
They fish in the deep water, rivers, lakes, ponds, *gadhahai* and streams.	Women fish in shallow water, by wading in shallow beds.	They fish in shallow water, lakes and paddy fields.
Help in drying and preserving the fish.	Carryout different processes for preservation of fish.	Help, in drying small fish.
Sell fish in the local market.	Carry fish in village for sale.	-
Spawn collection	-	Spawn collection.

horizontally, on which the fish are hung. The dehydrated fish are known as *sukhi*. They are used for sale and for consumption.

Fish oil

Oil is extracted from the leftovers like tails, fins, and bones of the fish. The remains are boiled and the oil is extracted by pressing the remains. This oil is used as food.

Consumption of fish

Fish satisfy food needs. They are dried and stored for later consumption in the following ways:

(i) Fish are roasted inside a hearth or in an open fire. They are rarely cleaned and cooked whole. Generally small fish are consumed roasted.

(ii) Fish are cooked with spices. Sometimes all the body parts including head are consumed leaving out only the fins, tail, scales and viscera.

(iii) Oil extracted out of fish is used for cooking and for massage.

The Mallah Settlement

The Mallahs have varied types of settlements:

(i) Settlement Type I: Temporary fishing settlements (occupied for several weeks)

(ii) Settlement Type IIa: Seasonal agricultural settlements on hill tops (occupied for some months duration)

(iii) Settlement Type IIb: Seasonal agricultural settlements on the land exposed by the receding Ganga (occupied for some months duration)

(iv) Settlement Type III: Year-round permanent settlements

Both the temporary and seasonal settlements among the Mallahs are temporary in nature with abandonment and reoccupation. Huts are used as shelters. The year round settlements are occupied throughout the year, especially during winters, which provides maximum protection against the cold. Rectangular mud houses are made as shelters.

Type I

These settlements are temporary in nature and are abandoned and reoccupied and are located close to areas where fishing and firewood are available. The settlement is occupied mainly in the rainy and partially in summer seasons. The location of the settlement is about 100 m inland or along the riverside. Sufficient space is left between the habitation area and the river in the rainy season so that the water level does not reach their temporary settlements during floods.

Thatched huts of temporary nature are constructed with bamboo or wood with two-sloped roofs made of hay and branches, which can easily be removed whenever necessary. Due to the movement of the fish during the fishing season, the Mallah do not bond to any particular place for a long time. The Mallahs discover new fishing sites for better catches. Houses are rectangular with a two-room hut, containing a kitchen, store and bedroom. One side is used for cooking and other for storing. Storerooms are also constructed separately lest the residue of food pollutes it. In some cases, the cooking is also done in an open place in one corner of the hut. Rooms remain open. The northern side of the hut is completely covered with roof due to the chilly northern wind.

Sufficient open space left in the front serves as a courtyard for drying fish. The Mallahs dry fish on the roof of the house or in the open on platforms or open ground. They construct racks for drying fish. These racks are constructed for maximum utilisation of sunlight. A common shrine is constructed in the middle of the settlement.

Fishermen anchor their boats and nets in their own area. No demarcation of boundaries is made at the settlement, but fencing of bamboo splits and dry tree branches is erected to ward off dogs and cats. Along the riverside a small area is chosen for sorting fish. A clear plot of land is used for this where fish are stacked when brought form the river. Fishing nets are also mended here. Thus utilisation of space in fishing camp is essentially correlated with the life activities of the fisher folk.

About five to ten families comprising 15 to 20 members inhabit these settlements. The occupants are mainly adult males and teenage boys. The huts have a linear arrangement with the doors facing the river. Cremation and burial is done in the main village which they inhabit on a permanent basis.

Disposal of bones in Type I settlements

The disposal of bones was seen:

(i) On the banks of the river

(ii) Behind the hut

(iii) In the hearth area

The hearths had fish bones, which were scooped after eating the meal. The scooped remains were thrown behind the huts or were scattered around the huts. The largest dump of fish and fish bones were seen near the banks of the river where the fish are stocked, after being brought from the river. Non-edible fish, weeds and heads of bigger fish are disposed off before bringing them to the settlement.

Type IIa

Seasonal agricultural settlements on hilltops are temporary in nature (Fig. 11). The settlement tends to be clustered and sometimes there is a summer and winter encampment, both of which remain unoccupied for some months of the year. These settlements were especially seen in the Vindhyan region on small hills near water sources (Fig. 11), which are suitable for both agriculture and fishing.

Thatched rectangular huts are used as shelter. They are loosely arranged and each individual family occupies a shelter. They are made on a temporary basis and are reoccupied after being abandoned for a few months. When reoccupied, materials like wood and stone are reused for construction. Every hut has courtyard space, storage rooms and outside pens. Living rooms are quite evenly spaced. The rooms are dark, as there is no window or ventilator for light and fresh air to come in. The storerooms are placed close to the living rooms. Storage bins are made to keep agricultural products. Threshing mud floors are usually located away from the huts so that the prevailing winds do not carry the chaff towards huts. There is a separate enclosure for keeping cattle. A covered space is provided in the enclosure where cattle can be kept at night (Fig. 11).

No religious structures were noticed in these settlements. The size of these settlements is three to seven families comprising 12 to 20 members. The huts are loosely arranged and tend to display a dispersed morphology. Cremation and burial is done near the main village or permanent settlement.

Disposal of bones in Type IIa settlements

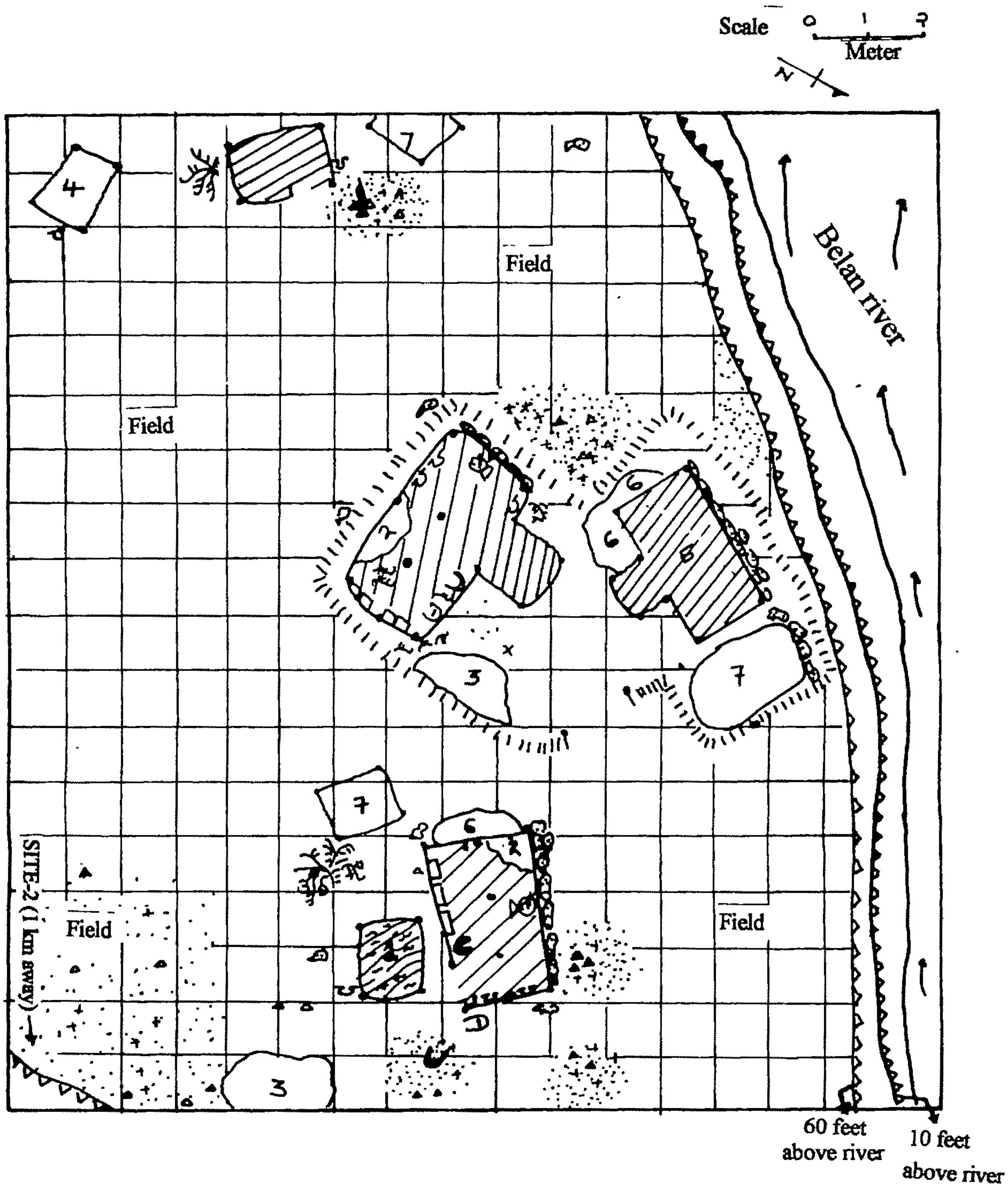
The disposal of bones was seen in the following contexts:

(i) Scattered in the agricultural fields

(ii) Dumped behind the huts

(iii) In the hearth area

The fish are brought to the settlement for consumption. Processing of the fish is done at the settlement near the hut. Sometimes the fish are caught, roasted and then consumed by children in the paddy fields. The fish brought back to the settlement are processed only before consumption. The fish remains inside the hearth were fragmentary. They were



Keys

1 Crop watch area
2 Belongings
3 Harvested crop pile
4 Crop watch tower
5 Crop storage hut
6 Agricultural tool
Mud platform with straw spread

□ Mud storage platform
Branches
Stone
Pot
+ + Scattered bones
△△ Potsherds
7 Cattle pen

Okhli
Hearth
Quern
IIII Fencing
∴ Ash
• Post hole

Fig. 11: Mallah Seasonal Agriculture Settlement

seen scattered around and behind the huts later they were scattered in the field as manure (Fig. 11). Besides, fish caught in the paddy fields were roasted and consumed, and bones were discarded in the fields.

Type IIb

These seasonal agricultural settlements are situated on the receding banks of the Ganga. They are seasonal in character and are occupied during summer for growing *zaid* crops. The habitation area is vast and huts are loosely arranged at a distance of 30 m from one another. Temporary huts are made with bamboo and have thatched roofs. They are used for sleeping, while cooking is done in the Mallah village across the river. The food is then carried to the settlement although *sigdi* or movable hearth is used for heating food and roasting fish. Wells are dug in the sandy soil to water the plants and for self-consumption. It is interesting to note that when the water level of the Ganga rises, all evidence of the settlement is carried away. When the Mallahs settle in the next season they start from scratch building new huts and wells.

No shrine was noticed in these settlements. About seven to ten families comprising 21 to 35 people inhabit these settlements. At night only male members of the family inhabit these settlements, while other members go back to the nearby permanent settlement. The morphology of the houses is dispersed. Cremation and burial is done near their permanent settlement (village).

Disposal of bones in Type IIb settlements

The bones were seen around the dwelling area mainly near hearth area. After the water level of the Ganga rises the river carries away all the material remains, and nothing remains at the settlement, including bones.

Type III

Year round permanent settlements are situated 1 to 2 km inland. The total area of habitation is 50 m in diameter. Thatched huts are constructed with a rectangular row of posts joined by wickerwork usually coated with mud paste, cow dung and chaff or straw (wattle and daub). The rectangular mud houses and huts are constructed in dense concentration. The roof is supported by vertical as well as oblique beams, and covered with grass, straw, reeds and sometimes with tiles, i.e., *khapra*. The typical shelter form is that of a one-room house. Some of the houses are more elaborate with two to three rooms, a kitchen, a grain store and an extensive courtyard. The main entrance of the house faces north. Storage bins are made to keep agricultural products. The rooms are usually dark, but sometimes a window is provided for ventilation.

Cattle, goats and hens are kept in the house at night. Community buildings like temples, which serve, as centres for religious functions, are usual, and stand out because of their greater size and ornamentation. The same applies to the house of the village head. Where social rather than economic factors prevail, the living huts are located around the core area comprising the village head's house, temple and other community buildings. Protection is commonly obtained through construction of palisades, thorn fences, and stone and mud boundary. Wells are dug for water.

About 15 to 25 families comprising 45 to 65 individuals inhabit these settlements. The morphology of the houses is dispersed. Circular and linear arrangement of houses was observed. The cremation and burial ground is along the riverside.

Disposal of bones in Type III settlements

Fish bones are disposed of in the hearth fire, or eventually thrown behind the hut or in the rubbish dump situated 15 to 20 m away from the settlement.

Thus, fish bones are seen in different contexts from different types of settlement. Fish remains provide information regarding the activities of the occupants, food habits and also to some extent the type of settlement in relation to the dispersal of fish bones.

Fish and Archaeology

The ethnographic study carried among the Mallah and the Musahars helped me in understanding the importance of fish and their possible remains in archaeological sites:

(i) Fishing practices develop as a local response to the geography and distribution of fish. Though fishing is done throughout the year, the main fishing season is during the rains and in the summer in rivers and lakes.

(ii) Fish remains at the site, if analysed, can show distribution of species, provide information about the climate, the season in which they were caught, food preferences and fishing methods.

(iii) The fish remains found at an archaeological site, or the death assemblage reconstructed, will not always shows the extent of fishing activity carried out on the site, because:

 (a) Fish hunted from the river and lakes are deposited in various places in different settlements. Different types of processing and butchery methods employed lead to different locations for deposition of fish bones. For e.g. the Mallahs do not carry the complete fish back to the settlement as they are already carrying considerable weight. The heads and fins are discarded at the bank of the river. Non-edible fish are left behind at the riverbanks and only the important fish stock is bought back to the settlement. Fish hunted by children are processed and discarded along the river or on the lakeside, paddy field or elsewhere. Thus, bones of a number of species consumed cannot be found in the dwelling area but are found near the actual fishing area.

(b) It is necessary to excavate both the fishing area (where generally butchering happens) as well as the dwelling area (disposal of bone) for better understanding the fishing activities involved if the archaeological site is situated along the river or lake.

(c) During extraction of oil most of the discarded body parts (tails, fins, and bones) are utilised, leaving the crushed remains behind.

Archaeological Evidence

The faunal assemblages at Mesolithic sites of the Ganga valley comprise of tortoise and aquatic remains besides other animals. The major sites referred to are as following:

The Mesolithic site of Damdama (26° 10' N; 82° 10' 36 E) in Ganga Valley has yielded evidence of animal based subsistence. A wide range of animals was exploited for food. More than 30 species (Thomas *et al.* 1996: 257, 259) of animals have been identified, comprising mammals 77.39%; reptiles (12.1%; tortoise *Lissemys punctata* and *Chitra indicia*- 10.93%); birds (8.96%; *Gallus gallus*), fish (1.25%) and molluscs (0.30%).

About 90% of the bones from Damdama are charred or semi-charred and were generally roasted in the pit hearths (Varma *et al.* 1985: 65; Pal 1994:100). The bone fragments reported were tiny (of about 1 to 3 cm in length) belonging to the main habitation area (Thomas *et al.* 1996: 257-259). The tortoise played an important role in their nourishment. Fish, molluscus and the other reptiles like *Trionyx gangeticus*, *Varanus* sp. and *Calotes versicolor* also share in the food economy at the site (Thomas *et al.* 1996: 258). The aquatic, avian and mammalian resources indicate that there was a specific trend as to which resource was used as against alternative ones. The mammalian and aquatic contribution shows cyclical trend (two phases of increase and two phases of decrease). The increase and decrease in the contribution of mammals were respectively compensated by corresponding decrease and increase of birds. In other words, the changes in the use of mammalian resources were mainly compensated by equivalent changes in the hunting of birds (Thomas *et al.* 1995: 34, 36).

From the Mesolithic site of Mahadaha (25° 29' 2" N.; 82° 11' 30" E.) thousands of bones were recovered particularly from the butchering and the lake area. From this 768 specimens were examined, out of which 319 belong to the lake area, 165 to the butchering area, and 284 to the cemetery-cum-habitation area from the level-Geometric Mesolithic without pottery. The occurrence of animal bones from the lake area shows that the disposal of refuse by them was deliberate. These assemblages comprised a number of mammals, bird, tortoise (*Chelonia*), and fish (Sharma *et al.* 1980: 211-212, 227). The bones found were in; charred, semi-charred and uncharred condition.

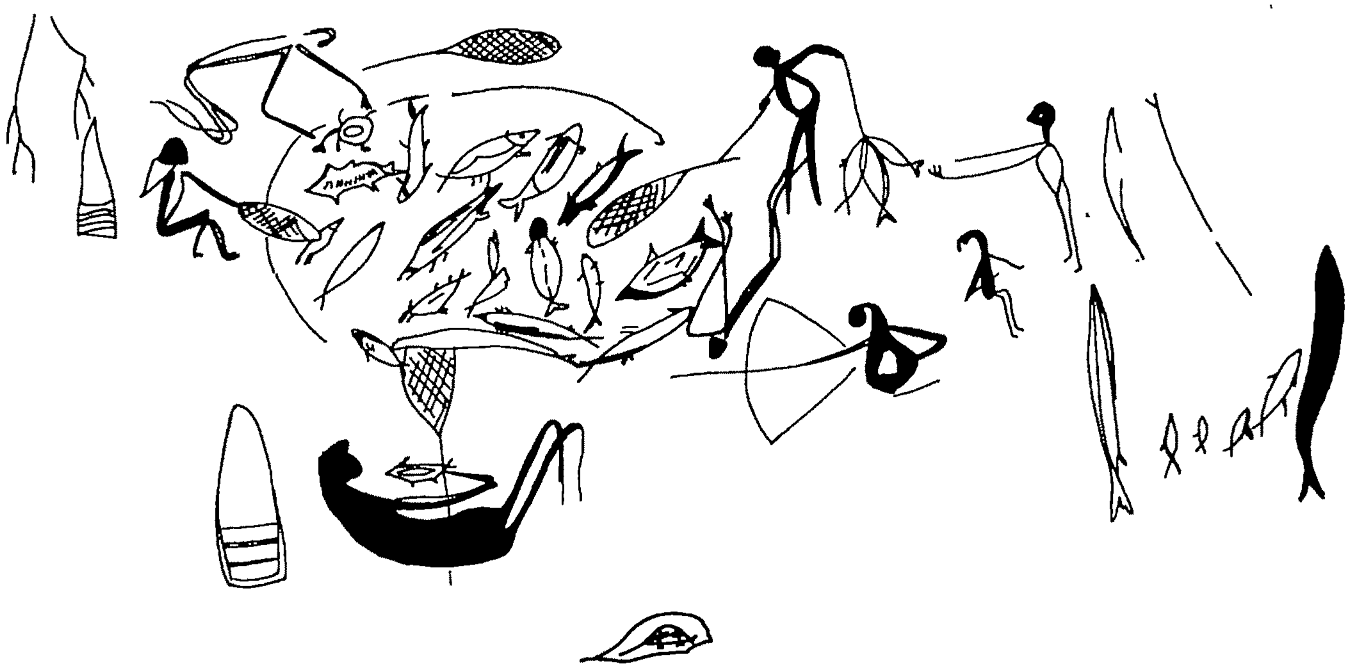


Fig. 12: Fishing and Rock art, Painting from Lakhajoar (District Raisen, Madhya Pradesh)

From the open-air Mesolithic site of Sarai-Nahar-Rai (25° 48' N; 81° E) the animal bones were fragmentary and were found from two locations i.e., hearths and floor area (Sharma 1973: 142). Those recovered from the hearths were in different stages of roasting with extensive soot on them. There were the dorsal plates and the shells of these reptiles. The faunal assemblage from the level — Geometric Mesolithic without pottery contained bones of mammals, tortoise (*Chelonia* sp.) and fish.

The animal bones recovered at the site throw light on the economy of the people. It was primarily based on hunting and fishing and flesh was one of the main dietary items.

Fish and Rock Art

The evidence of fishing is depicted in rock paintings (Neumayer 1993: 78-79) of early hunter-gatherers at Lakhajoar (District Raisen) near Bhimbetka in Madhya Pradesh. A detailed fishing scene (Fig. 12) depicts people catching fish from a small pond or waterhole. A person's pouch is hanging from the branch of a tree. A hand net is placed on the ground to allow its owner to catch a turtle with both hands. Another person has strung several fish onto a rod for easy transport. Others are fishing by nets and by bow and arrow. Different types of fish are kept are kept on one side. Other rock paintings at Kerwaghat, Kowar Khoh and Gojara, District Mirzapur in Uttar

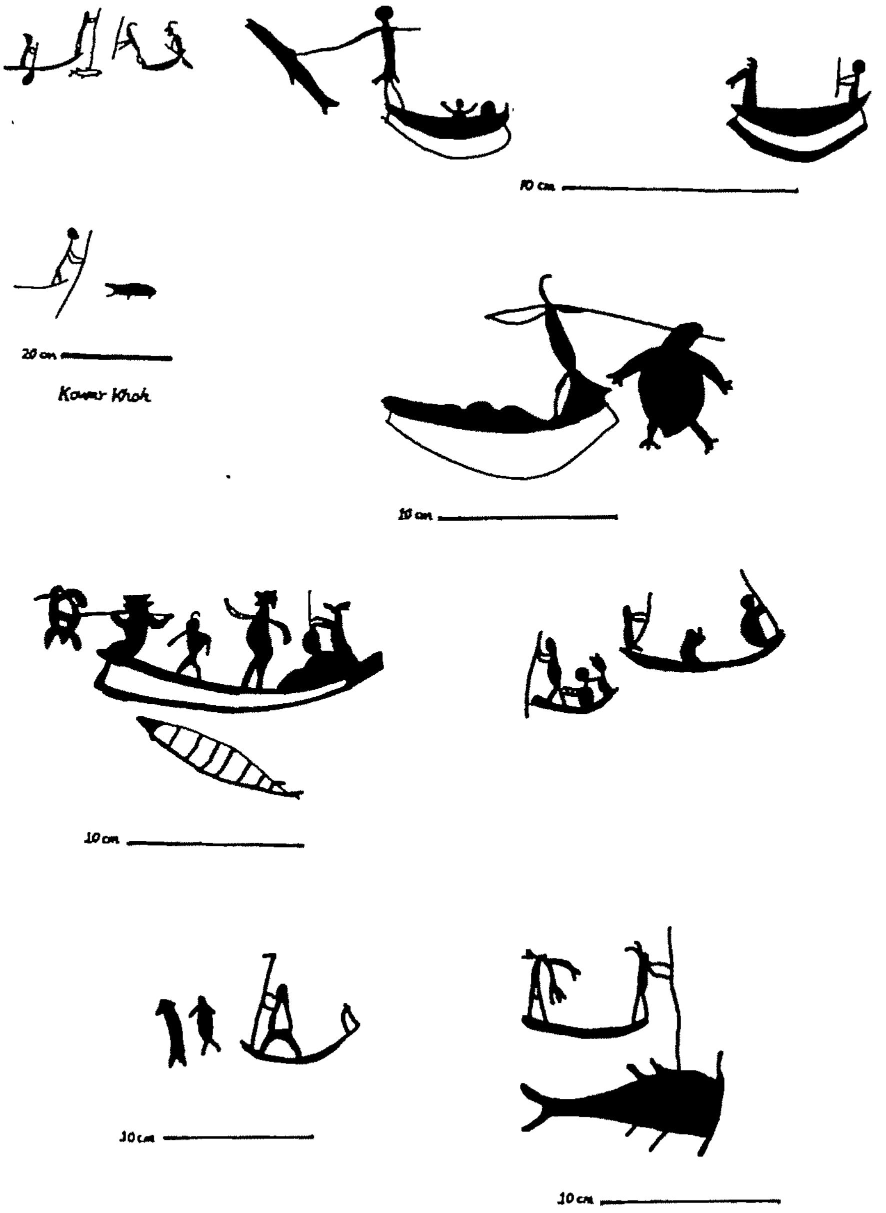


Fig. 13: Paintings from Kerwaghat, Kowar Khoh and Gojra (Mirzapur, Uttar Pradesh)

Pradesh in the northern parts of the Vindhya Hills depict fishing scenes of the hunter and food gatherers (Neumayer 1993: 108, 112,113). Here boats, generally manned by two persons, one at the stern handling the paddle, the other spearing fish or turtles (Fig. 12), do fishing.

These rock paintings show that the fishing technique several thousand years ago was not much different from that of today.

Conclusions

The evidence of prehistoric diet can be seen from the Mesolithic sites of Ganga valley, which included tortoise (*Lissemys punctata* and *Chitra indica*), and fish. These remains certainly show the importance of aquatic animals. It is difficult to evaluate how much aquatic animals contributed to the diet of the Mesolithic people from the meagre remains recovered. Despite their dietary potential, fish are generally assigned minor significance in archaeological interpretations. Ethnographic study among the Musahars helped to understand that every part of the fish is consumed. Thus, they are likely to leave few archaeological traces.

The Mallahs have three types of settlement: Temporary Settlements, Seasonal Agricultural Settlement IIa & IIb and Year Round Permanent Settlement. Their mode of subsistence is fishing. They employ varied types of fishing techniques similar to those found in the rock art from nearby areas (Raisen District, Madhya Pradesh and Mirzapur district, Uttar Pradesh). In the off-season they shift to seasonal agricultural settlements on hills or onto the sandy bank of the receding Ganga although they continue fishing along with agriculture.

It was noticed that while interpreting any archaeological site it is very important to note in which context the fish remains are found. The disposal of fish bones in the Mallah settlements is in the hearth area, in a dump behind the hut or scattered near the settlement, in agricultural fields and on the riverbanks (butchering area).

It is very interesting to note that the dispersal of bones at temporary settlement is near riverbanks and not in the settlement. The Mallahs clear a small plot of ground near the riverbanks, where they stack the fish caught from the river or lakes. Non-edible fish are discarded here and butchering is also done near the riverbank.

Considering the habits and ecology of the various species of aquatic animals recovered, it is possible to reconstruct the sources likely to have been exploited by ancient man. Thus, the hunting methodology adopted by the primitive communities might show a lot of similarity to prehistoric practices. Bone hooks may have been used, but little evidence has come to light during excavation. There is no direct evidence for the use of nets or traps, but small fish could have been just collected with the help of cover baskets or by hand as depicted in the rock paintings.

Fishing by hand and with sticks is the most primitive type of fishing technique among the Mallahs and Musahars; it shows the minimal use of tools for fishing. The raw material used for making fishing tools and traps is locally available. Much of it consists of bamboo, which is easily obtained from the nearby forest. While cotton and nylon strings for weaving nets, iron hooks and net sinkers are obtained from local markets.

This study has helped in understanding the significance of fish remains in Mesolithic diet of the Ganga Valley.

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Indian Palaeolithic Collections in the Smithsonian Institution: International Exchanges and their Archaeological Potential

Michael Petraglia and Michael Noll

Department of Anthropology
National Museum of Natural History
Smithsonian Institution
Washington, D.C. 20560 USA

Abstract

Palaeolithic collections from India are housed in the Smithsonian Institution, Washington, D.C. (USA). Nine accessions were recorded as donations and exchanges from 1883 to 1959. The majority of the collections were obtained during the height of British colonial domination of India and at a time when the rapidly developing Smithsonian Institution desired collections from around the world. The Indian collections are historically significant as they portray the circumstances surrounding the acquisition of Palaeolithic objects for potential exhibits and comparative studies. The museum collections indicate the location of important Palaeolithic sites and they are valuable for addressing aspects of Acheulian technology and behaviour.

Introduction

A large collection of Palaeolithic material from around the world is housed in the Smithsonian Institution, Washington, D.C. (Petraglia and Potts 2001). The Old World Palaeolithic collections were acquired for over 140 years, resulting from international exchanges, gifts, purchases, and field expeditions. Except for examination of some French Palaeolithic objects and assemblages (Petraglia and Potts 1992; Petraglia *et al.* 1992; Vandiver *et al.* 1994; Petraglia *et al.* 2001 a), few of the Smithsonian collections have been reported and properly studied. A small, but valuable, component of the Smithsonian collections are from India. This article informs Palaeolithic researchers about the Indian collection and the circumstances surrounding their procurement.

The late nineteenth and early twentieth centuries were a period when anthropology and archaeology were developing (Daniel 1975; Grayson 1983; Trigger 1989; Willey and Sabloff 1993; Patterson 1995). The procurement of Indian collections is typical of common museum practices over the turn of the 20th century, which tended to place emphasis on material culture and successions. In reviewing the circumstances behind the acquisition of the Indian collections, information on the historical development of the archaeological discipline may be gathered, as the transfer of material culture indicated the motivations of dominant institutions and scientists. Indian collections were sent to America by institutions and individuals who were associated with British rule. Thus, the collections represent a small, but important component of the antiquities obtained from a country that was undergoing British colonial domination. At the same time, Smithsonian administrators and scientists strongly desired to procure "representative" and "comparative" collections from around the world in an attempt to build a major museum for education, research, and exhibition (Petraglia and Potts 2001).

Eight museum accessions of Indian Palaeolithic material were recorded at the Smithsonian Institution over a 45-year period, from 1883 to 1928, with one accession arriving after independence from England, in 1959. The objects in the nine accessions were recorded and inventoried, and some were placed on display, but they were never studied or published. Records pertaining to the collections were obtained from the Smithsonian Institution Archives; the National Anthropological Archives; and the Office of the Registrar, National Museum of Natural History. The archival and accession records provide artefact inventory and letters of correspondence pertaining to the transactions. As was common during this period, general information on the location was recorded, but precise contextual information was not provided.

C.A. White Accession (26918)

The first recorded accession of Palaeolithic material from India dates to 1883, when three bifaces from Madras were received as a gift (Fig. 1). The donated objects were received from the American geologist, C.A. White, associated with the United States Geological Survey (USGS). White was in contact with the Smithsonian's first

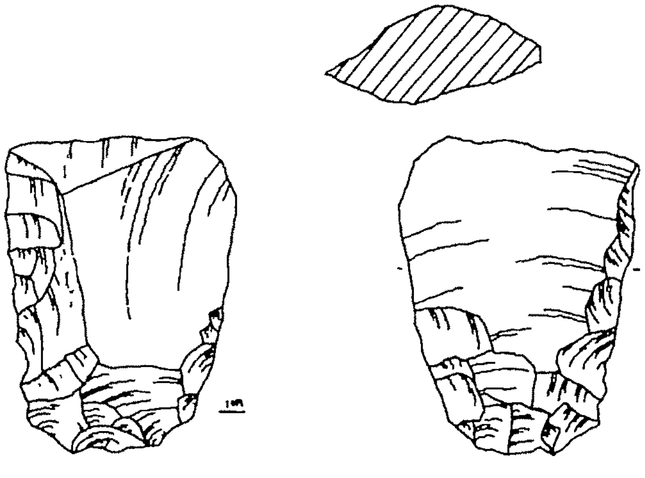

Fig. 1: Cleaver, on quartzite, Tamil Nadu District (acc. 26918, cat no. 88189)

and second Secretaries, Joseph Henry and Spencer F. Baird, whom he usually corresponded with on geology and palaeontology. The Palaeolithic objects were obtained by White from the Geological Survey of India. The records identify the provenance of the objects as coming from the southeastern part of the country, "near Madras", although the objects are more specifically labeled as coming from the "Tamil Nadu District" (then part of the Madras Presidency or Madras State).

Edward Lovett Accession (20116)

Beginning in the early 1880s a number of diverse exchanges were made between Edward Lovett, of Croydon, England, and the Smithsonian Institution. Lovett was an avid collector of ethnological and archaeological materials. Smithsonian Curator Otis Mason described him as, "an officer of the Bank of Scotland... deeply interested in primitive culture", further noting, that Lovett "has filled his house with all sorts of nice things from different parts of the world" (letter dated June 25, 1908, to Alfred Kroeber, professor of anthropology at the University of California).

In 1884, Lovett was in correspondence with the Smithsonian Assistant Director, George Brown Goode, and Curator Otis Mason concerning potential exchanges. Lovett wrote to Mason on November 7, 1887, requesting an exchange,

> I understand your museum is not well off in European and British ethnology. I beg to enclose a list of a few things I could send you. They may or may not be of service to you, but some of them may; and if you came to select any, I will send them carefully packed and fully labeled, and you could send me in exchange a few more of your duplicate ethnological specimens. I will not say now what sort of things I am in want of, but when I send (if you select any) I will then tell you what I want and I am sure you will do what you can to oblige me in this way.

Mason apparently desired such a collection, and on January 7, 1888, Lovett wrote to Mason concerning the shipment,

> "Some of the contents are rough and may be perhaps plainly called flakes, whilst others like the two Madras palaeoliths are rare and valuable".

In a letter to Mason on January 27, 1888, Lovett states his desires,

> "As regards exchange I have already sent you a greedy list of wants to which I have not the bad taste to add; but if you will allow me to say it, I might tell you that many things that are common to you would be valuable to my museum, and also that in case of variety a broken or fragmentary specimen would be better than none at all; also, that when you are really able to spare more than one of a thing I can find room for two or three; as I like series where possible".

As a result of this contact, archaeological objects from Europe and India were received as an exchange for ethnological and archaeological objects from North America. The material from India was described as "two rude quartzite Palaeolithic implements from laterite beds" of Madras.

Sir Henry W. Seton-Karr Accessions (40597, 47957)

From 1896 to 1907, Sir Henry W. Seton-Karr, from Wimbledon, Surrey, England, was in correspondence with Smithsonian administrators and officials concerning the purchase of natural history specimens, including archaeological collections from Europe, Africa, India, and Asia. According to Smithsonian documents, Seton-Karr was considered a "big-game hunter" and "discoverer of archaeological sites", who made "profits from sales of objects to various museums". Seton-Karr was admitted to the Bar in 1879, and he served 20 years as a Conservative Member of Parliament (Zeni 1998). At the age of 61, Seton-Karr died a tragic death with 1,012 other passengers on the RMS Empress of Ireland, an ocean-liner which sank as a result of a collision, on May 29, 1914, in the gulf of the St. Lawrence River in Canada (Zeni 1998). Seton-Karr's archaeological discoveries and collecting was recounted by Jacques de Morgan (1926: 156-57) in the book, *La Prehistoire Orientale*.

Morgan (1926) described many of the localities that Seton-Karr discovered in Somalia, noting that artefact assemblages were curated in the Muse de Saint-Germain, France. Morgan describes the Egyptian specimens as chipped stone tools from mines, whereas those from

Somalia and India were noted to be Palaeolithic objects. It was from these collections that Seton-Karr proposed a sale of artefacts derived from Somaliland (Somalia). In 1897, the Smithsonian purchased the Palaeolithic collection, which was considered extremely valuable to the museum. From these documents, it is apparent that Seton-Karr's collections from these localities reside in several museums in Europe and North America.

Somewhat later, as described in a Seton-Karr's letter dated January 1, 1903, Seton-Karr offered to donate archaeological objects from India. The donation was accepted (acc. 40597), and it contained 15 Palaeolithic "implements", noted to be "from the laterite deposits of Poondi, 29 miles west of Madras" (Figs. 2, 3). Seton-Karr shipped 96 implements obtained from the laterite deposits at Poondi, requesting that the Smithsonian coordinate the distribution of material as follows: the Museum would retain 5 good examples and 10 others, and other institutions would get the 81 remaining pieces including the University of California, Berkeley, the Field Columbian Museum, Stanford University, Amherst College, the University of Pennsylvania, and the Drexel Institute. In a memorandum dated February 19, 1903, Curator William Henry Holmes wrote to Mason stating that he would assist in distributing the specimens according to Seton-Karr's wishes. In a letter dated March 9, 1903, Rathbun wrote a form letter to the six institutions, "At the request of Mr. H.W. Seton-Karr (31 Lingfield Road, Wimbledon, S.W., London, England), I am sending you by express a box containing some Palaeolithic implements which he collected in the lateritic deposits at Poondi, near Madras. Mr. Seton-Karr begs that you will accept the specimens for the institution over which you preside; that they be suitably exhibited and labeled; and that you will send him an acknowledgment of their receipt".

Stimulated by a personal visit to Washington in 1907, Seton-Karr wrote to Assistant Secretary Richard Rathbun on June 23, querying him about the establishment of exhibits, "I forgot whether during my last visit to Washington you said that there would be a gallery or place devoted to the stone age of Europe, Africa, and Asia; my impression was that at present the foreign things were not represented. I think I donated Somali, Egyptian, and Indian collections to you? I should be pleased to present my own private collection of selected implements if you would inform me whether it is intended to add a prehistoric foreign gallery to the Museum". In reply, Holmes wrote to Seton-Karr, "I was pleased to hear from you and glad that you made the inquiry in reference to our exhibit of archaeology, from Europe, Africa, and Asia. I may say that the nucleus of a collection in which your contributions occupy a prominent place in value and importance is exhibited in the great Hall of Prehistoric Archaeology where as much as is possible under our present limited space is put on view. The new building will allow healthy expansion and there will be a separate hall or space devoted to Europe, Asia, and Africa. Permit me to thank you in the name of culture history students for your interest in this research and in museum-building and to assure you that your contributions of prehistoric objects are much appreciated". Rathbun also responded to Seton-Karr on August 10, 1907, indicting the importance of the future exhibits, "Replying to your inquiry as to whether it is the intention of the Museum to provide for the exhibition of prehistoric foreign objects, I would say that the nucleus of such a collection, in which I need hardly mention that your contributions occupy a prominent place, is already on exhibition in the Hall of Prehistoric Archaeology in the Smithsonian building, where as much space as is now possible has been assigned to it. In the new Museum building, now in the course of erection, it is planned to have a separate section entirely devoted to the archaeology of Europe, Asia and Africa, and in this space, I shall be very glad to exhibit your own collection, which you have so generously offered to present, and which, I may add, the

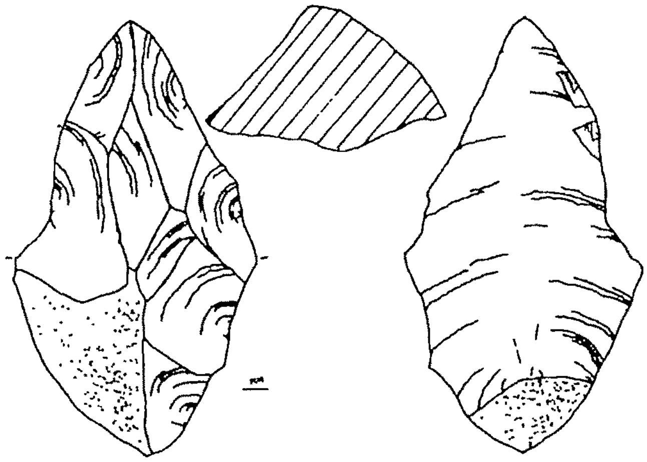

Fig. 2: Handaxe, on quartzite cobble, Poondi (acc. 40597, cat no. 219535)

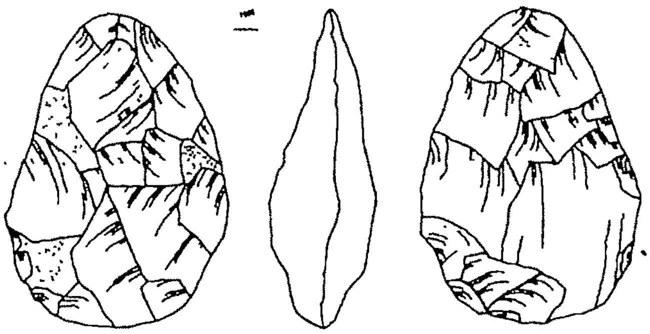

Fig. 3: Handaxe, on quartzite, Poondi (acc. 40597, cat no. 219540)

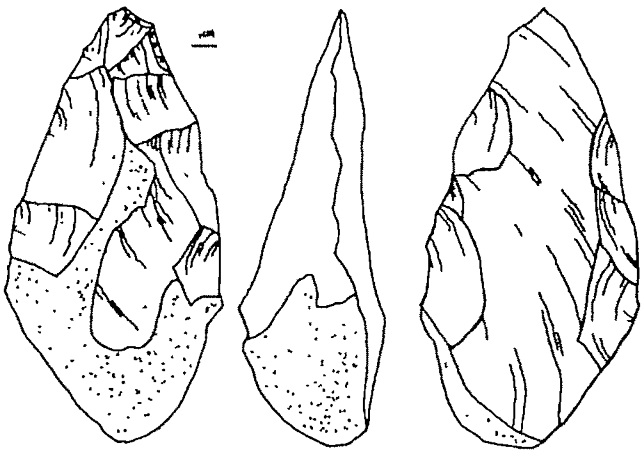

Fig. 4: Pick, on quartzite, Pennar River Valley (acc. 47957, 248176)

Museum will be glad to receive". Apparently satisfied with responses from both Holmes and Rathbun, Seton-Karr then donated a second collection of material from India, composed of 83 specimens from the Pennar River Valley (acc. 47957) (Fig. 4).

Seton-Karr wrote to Rathbun on September 19, 1907, describing the provenance of the Indian objects and the nature of the discovery,

> In accordance with my promise, I have much pleasure in donating the following from my private collection to your museum if you will honour by accepting them. The remainder consists of a splendid series of Palaeolithic implements from the Pleistocene laterized alluvium of the Pennar River Valley, now high up on the hillsides, and dug from a depth of many feet, generally by natives digging water-pits. I hope you will be able eventually to give them a good location with suitable inscriptions in the new foreign prehistoric section of the National Museum. Might I suggest that when Museum labels are attached it makes it more interesting if it is made plain that the donor is (as in this case) also the finder; otherwise the objects might be supposed merely to have been purchased.

In a memorandum dated November 19, 1907, Rathbun wrote to Seton-Karr, noting that Holmes considered the collections to be of profound significance, "These specimens have been examined by the Curator of Prehistoric Archaeology, and they are regarded by him as of exceptional interest and value. The collections, after cataloguing, will be exhibited to the best possible advantage in the foreign prehistoric section. Your observation on preserving the collector and donor both in the literature and on the label hits the root of the matter — the one giving material the other life and value". In the letter, the Assistant Secretary made assurances that the collection would be exhibited and the labels would signify that the collector and donor was none other than Seton-Karr himself.

Madras Government Museum Accession (88426)

In 1926, a single Palaeolithic specimen from Madras was received as a gift from the Madras Government Museum (Fig. 5). The donation was the result of a visit to India by Aleš Hrdlika, Curator at the Smithsonian, a major figure in the development of modern Physical Anthropology (Spencer 1997). In 1925, Hrdlika traveled to India during his international trips in search of anthropological, archaeological, and palaeontological collections. In a letter dated April 28, 1925, Hrdlika wrote to the Curator Walter Hough from India, and after some discussion about travel, modern peoples and race, and collections, he noted, "Am now on the way to Calcutta to examine their collections. From there will probably go direct to Madras, where they have the largest collection of the 'palaeoliths'". Hrdlika wrote about his travel to Madras in an unpublished manuscript,

> A great collection of Palaeolithic implements is preserved in the Museum at Madras. These implements are similar to those of other parts of India. They are all of one general class, so much that there can hardly be a question as to their contemporary origin in the different parts of India and their connection with people in the same race and belonging to the same though perhaps a large cultural period. They do not show great variety. They resemble some for the Palaeolithic implements of Europe, but on the whole cannot be associated with any one of the European cultural periods. They are something apart and, according to indications, hardly very ancient. In certain parts of India, such as the Santal country north of Calcutta, such implements have been collected in thousands. They are found by the farmers as they

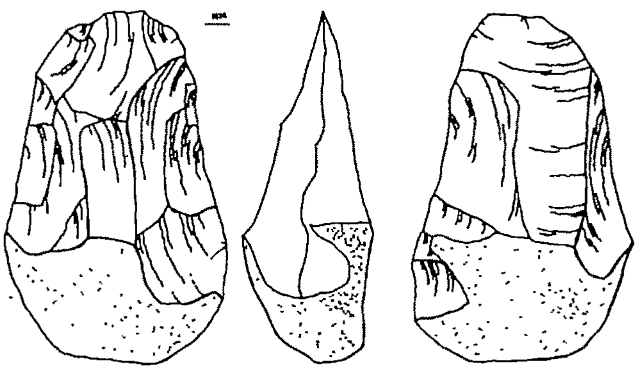

Fig. 5: Handaxe, on quartzite cobble, Tamil Nadu District (acc. 88426, cat no. 330426)

> plough, and curiously, ... the natives call them 'lightning stones'. In other parts, especially near Madras, they are partly on the surface soil, partly from one to four or five feet and even deeper below the surface. In places, they occur in the alluvium of the rivers and occasionally in the 'laterite' a talus-like debris resulting from the disintegration of the older rocks. In short, evidence as to early man in India up to the present, may be reduced to the statement that there are plentiful Palaeolithic implements over large portions of the country, but that as yet they do not in any case definitely indicate a man of geological antiquity.

The Assistant Secretary, Alexander Wetmore, wrote to Dr. F.H. Gravely, Director of the Government Museum, on June 30, 1925, requesting material from Madras, "Dr. Aleš Hrdlika, Curator of Physical Anthropology in the U.S. National Museum, has written to me of his recent visit to your museum, and I would assure you of my appreciation of the many courtesies which you have extended to him. We would...like to secure a copy of each of the four catalogues of ancient implements published by your museum as well as a small representative collection of duplicates from your large collections of 'palaeoliths' of southern India. Please be assured that this museum will be glad to exchange any of its duplicate specimens which may be desired". As a result, a single Palaeolithic object was sent to the Smithsonian, as acknowledged by Wetmore in his letter of January 8, 1926.

Reverend P.O. Bodding Accession (90169)

In 1926, six Palaeolithic implements were received as a gift from Reverend P.O. Bodding of Mohulpahari (Mahulpahari), Santal Parganas, India, as part of a larger collection of archaeological objects, mainly Neolithic in origin. In a letter to Wetmore on October 21, 1925, Bodding acknowledged receipt of a collection of the Smithsonian's Annual Reports, indicating that it would be of assistance for his work on linguistics and ethnology. Bodding indicated how the subject of the potential gift was first raised, "When I had the pleasure of meeting Dr. Hrdlika here in May I promised him that I should send a sample collection of ancient stone implements found here in this district. I am having these packed and shall forward them through your Consul General in Calcutta very soon. I am sending samples of the different kinds met with here". Confirming the transmission of the collection, Bodding wrote to Hrdlika on November 11, 1925,

> At last, I have been able to send the stone implements I promised you when I had the pleasure and privilege of meeting you in Darjeeling. They are packed in a wooden box which I sent down from the American Consul General in Calcutta, and I have an acknowledgment from him that he has received the box and will send it as soon as possible to Washington. I waited so long, partly because I wanted to be sure that you were back in Washington, partly because I wanted to try to get hold of one special and very seldom form. I have sent in all 100 specimens, some fairly large ones, many quite small, so it is not easy to understand what they may have been used for. They are all found here in this district. (If you look at a map of India, you will see when the Ganges commences to turn to the south of the Ganges here).

In a letter dated December 9, 1925, Hrdlika wrote to Bodding, "We have just had from our Consul in Calcutta the welcome news that you are ready to send us a lot of the stone implements from your region. They will be of great value". Assistant Secretary Wetmore wrote to Bodding on March 24, 1926, formally acknowledging receipt of the collection. After examining the collection, Hrdlika wrote to Bodding on April 19, 1927, indicating that he believed that the assemblage was an assortment of stone age material, "The stones from you came in good condition. They evidently date all from the later or polished stone period, though some of them are not polished. There are no new forms, but the collection is a very interesting one nevertheless, and is I believe the only one of its kind in America".

D.I. Bushnell Accession (93521)

In 1926, a collection mostly from various localities in Europe, was received as a gift from D.I. Bushnell of Washington, D.C. Accompanying the gift was a single Palaeolithic object from India, noted to be from Poondi. The objects were brought in person, and there are no accompanying records, except for a formal letter of acknowledgment from the Administrative Assistant to the Secretary, W. De C. Ravenel, on October 13, 1926.

Indian Museum, Calcutta Accession (88427)

In 1928, an exchange was made for a collection of stone implements from India, with the Indian Museum in Calcutta, through Rai Bahadur Ramaprasad Chanda, Superintendent of the Archaeological Section. The exchange was made as a result of Hrdlika's personal visit to the Museum. Administrator Charles G. Abbot of the Smithsonian wrote to Sir John Robert Marshall, Director of the Archaeological Survey of India, on June 25, 1925, requesting an exchange, "Dr. Aleš Hrdlika, Curator of Physical Anthropology in the U.S. National Museum, has written to me of his recent pleasant visit to your department. He advised me of the very interesting work being done by the Archaeological Survey of India and has asked that I request you to favour this Museum with a small collection of representative duplicates of Indian 'palaeoliths' from the large collection now under your care in the Museum of Calcutta. We would, of course, be glad to send in exchange whatever you might wish from the collections in this museum along the same line". In a positive reply, dated June 15 1926, Chanda wrote, "I beg to state that I shall be very glad to spare a set of small representative collection of the Indian Palaeoliths for exchange with your Institution, and in exchange I should like to have a representative collection of American palaeoliths". The materials were from three localities in India, the Chingleput District, the Cuddapah District, and Marpha (Marfa), in Uttar Pradesh. In reply, on December 8, 1926, Assistant Secretary Wetmore stated a box containing 94 American stone implements were forwarded to India in exchange.

Dr. S.T. Satyamurti Accession (202973)

In 1959, an exchange was made for ethnographic materials and two Palaeolithic artefacts from Madras State, India, through Dr. S.T. Satyamurti, Assistant Superintendent, Government Museum, Madras. In a letter dated June 6, 1954, Superintendent C.J. Jayadev, inquired about the possibility of an exchange, and on August 17, 1954, the Curator, Frank M. Setzler, replied positively. In a letter dated June 10, 1955, Dr. A. Aiyappan, Superintendent, wrote to Setzler and offered specific objects from India, including Palaeolithic stone implements from South India of the Madras facies are offered for North and South American ethnographic materials. In a letter to Aiyappan, dated September 20, 1955, Setzler suggests as a preliminary exchange, a type sample of Palaeolithic stone implements be sent, suggesting that if the exchange is mutually beneficial to both sides, a more comprehensive exchange may be latter arranged of materials from the duplicate reserve collections of both museums. The accession included a cleaver from Attirampakkam, and a chopper from Manjanakaranai, both in the Kortallayar Basin, Chingleput District.

Discussion

Historical Roots

The Palaeolithic collections from India provide a glimpse into the transfer of archaeological objects over a period extending nearly 80 years. The collections, albeit small in number and probably biased in collection from the field, are indicative of larger trends in the history of the discipline. The stone tools are snapshots concerning common practices during the British rule of India and the desires of Americans to develop a renowned national museum that would own objects of every kind from around the globe. In addition to their historical value and interest, the stone tool collections inform modern day researchers about potential locations of Palaeolithic sites, and coupled with some current observations of technology, they suggest that re-evaluations of these particular contexts may be worthwhile for behavioural interpretation.

With respect to scientific and intellectual developments, the first accession came to the Smithsonian twenty years after Robert Bruce Foote's landmark discovery of a Palaeolith in 1863 in the lateritic gravel at Pallavaram near Madras (Foote 1866). Foote was associated with the Geological Survey in British India, based in Madras (Pappu 1991-2, 1996 a; Korisettar 2000). From 1863 to 1884, Foote conducted an extensive survey of the Madras region. Given that Foote was a British geologist, it is perhaps not surprising that this first Smithsonian collection was obtained by C.A. White, a American geologist who received the objects from the Geological Survey. The majority of the Smithsonian collections arrived between 1884 to 1928, when these objects were referred to as "Palaeoliths". The period during which the objects arrived at the Smithsonian is also known as a hiatus in Palaeolithic studies in India, occurring after Foote's field studies terminating in 1884 and before the establishment of Cammiade and Burkitt's (1930) developmental sequence. Despite arguments to the contrary (Foote 1916), Hrdlika questioned, in his unpublished manuscript, the deep geological antiquity of the Palaeoliths and their resemblance to those of Europe (this is reminiscent of Hrdlika's adamant argument against the early age of New World Palaeoindian cultures [Willey and Sabloff 1993]). After culture-stratigraphic relationships were worked out beginning in the 1930s, the formerly known Palaeoliths were later referred to as "Madrasian" industries or the "Madrasian Handaxe Tradition" (Cammiade and Burkitt 1930; Krishnaswami 1938; deTerra and Paterson 1939). After the conclusion of World War II, and with the birth of the new Indian nation, antiquities transactions by the home country came to a virtual halt, but they played a major role in global synthesis (Movius 1948). The objects from Attirampakkam (also Attrambakkam) and Manjanakaranai, from the 1959 accession, are associated with historically important sites that were first subject to detailed work by Krishnaswami (1938, 1947) and more recently followed up by others (Reddy 1994; Pappu 1996b, 1999; Achyuthan and Pappu 1997).

With respect to distribution and access to Indian collections, the eight accessions acquired from 1883-1928 were small parts of larger collections that were dispersed through purchases and exchanges by various individuals and institutions. Portions of these stone tool assemblages reside in institutions, museums, and private collections in western Europe and North America. The Seton-Karr accession is clearly indicative of this trend, as the original collection was further subdivided and sent to universities and museums throughout the United States. While the administration of the Smithsonian clearly appreciated the new acquisitions, material from India is not plentiful compared to western European collections, particularly from France and England, which was the main obsession of the American Administrators and Curators (Petraglia and Potts 2001). Access and control over the Indian materials for donation and exchange prior to Independence is exemplified by transactions by British institutions or individuals, including the Geological Survey of India, Mr. Edward Lovett, Sir Henry Seton-Karr, Dr. F.H. Gravely, Reverend Bodding, and Sir John Robert Marshall. The collections donated by museums were likely collected before the transactions, as those from South India in the Calcutta Museum were likely originally procured by Foote, those from Marpha were likely obtained from its discoverer A.C.L. Carlyle (Cook and Martingell 1994), and those in the Madras Government Museum were likely originally procured by Foote or his colleague William Fraser King. Seton-Karr therefore likely obtained artefacts from the South India sites already reported by Foote or King. Some of these same collections are in the British Museum, as there is a Carlyle collection in British Museum from Marpha, and the Seton-Karr collection include artefacts from various areas including Cuddapah and Madras; moreover, W.A. Sturge also purchased palaeoliths from Seton Karr provenanced to Cuddapah (Cook and Martingell 1994). At least three of the eight accessions from 1926-1928 were stimulated by Hrdlika's personal trip to India. The ninth and final accession, dating to 1959, is from post-Independence, which appears to be motivated by Indian researchers to acquire material from abroad, perhaps as representative objects for comparative purposes or display.

Locations

The archaeological materials in the nine accessions are from general geographic areas ("near Madras"), districts (Chingleput, Cuddapah), valleys (Pennar), and specific locations (Poondi, Mohulpahari, Marpha) (Table 1). Most of the collections are from the southeast coast of India, within the modern day states of Andhra Pradesh and Tamil Nadu. The bias towards this geographic area is likely related to the rich nature of the Palaeolithic record in this region and the administrative presence and interests of British citizens and scientists of the Geological Survey in Madras.

The accession information provides some interesting notations about the potential context and preservation of the sites. Localities are noted to be associated with laterites, as observed for many occurrences of South India (Korisettar and Rajaguru 1998). The Poondi materials were noted to be from laterite "beds" or "deposits" and those from the Pennar River Valley were from "Pleistocene laterized alluvium" — noted to be at a high elevation, and recovered many feet in depth by villagers digging wells. Recent re-evaluation of the Kortallayar Basin, encompassing the Chingleput District, Poondi, and the Pennar River Valley, has been undertaken (Pappu 1999), indicating that many Palaeolithic sites are indeed associated with ferricretes. Sites in the vicinity of Poondi were found to be buried in low energy ferricrite sediments and only exposed

Table 1: Palaeolithic collections from India curated in the Smithsonian Institution

Name	Date	Accession	Locality	No. Objects
White	1883	26918	Near Madras, Tamil Nadu District	3
Lovett	1888	20116	Poondi	2
Seton-Karr	1903	40597	Poondi	15
	1907	47957	Pennar River	83
Madras Museum	1926	88426	Madras	1
Bodding	1926	90169	Mohulpahari	6
Bushnell	1926	93521	Poondi	1
Indian Museum	1928	88427	Chingleput District	17
			Cuddapah District	10
			Marpha	20
Satyamurti	1959	202973	Chingleput District	2

Table 2: Descriptive statistics for length, breadth, and thickness of biface collection

Type	N	Length (L)			Breadth (B)			Thickness (T)		
		Mean	SD	CV	Mean	SD	CV	Mean	SD	CV
Cleaver	9	134.89	16.02	0.12	92.00	15.23	0.17	41.67	5.64	0.14
Handaxe	55	124.36	28.87	0.23	76.86	15.92	0.21	38.36	11.91	0.31
Knife	2	144.50	0.71	0.01	82.00	4.23	0.05	55.5	3.54	0.06
Pick	8	145.25	25.93	0.18	81.00	14.94	0.18	50.38	7.05	0.14
Total	74	128.45	27.66	0.22	79.28	16.11	0.20	40.53	11.56	0.29

today because of modern quarrying and construction activity (Pappu 1999). Most recently, excavations undertaken at Attrambakkam have shown that Lower Palaeolithic assemblages are associated with ferricretes and clays (Pappu 2001 a). The association of artefacts with these type of deposits can be verified in the Smithsonian collections since some still have adhering laterite encrustations and sediments on their surfaces. With respect to the condition of the objects, some bifaces from Poondi and Pennar show relatively sharp edges and highly distinguishable flake facets, whereas others are in poor condition, with rounded edges or heavy material weathering. Those that occur in laterites with non-rounded edges may suggest that relatively intact sites are present in these particular valleys, similar to the findings from other South Indian sites with quartzite assemblages, such as those from the Cuddapah region (Raju 1988), the Kortallayar Basin (Pappu 1996b, 1999) and the Malaprabha Valley (e.g. Pappu and Deo 1994; Petraglia *et al.* 2001b).

Technological Assessment

The nine accessions contain 160 stone tools, varying from a single object to as much as 83 stone tools in one accession deposit (Table 1). While the total number of objects is relatively low from the nine accessions, a high frequency of bifacial tools is represented, obviously denoting a bias towards the recovery of formal tools. Given their characteristic styles, sizes, and flaking attributes, the bifacial artifacts are characteristic of the Acheulian (Misra 1987). The high frequency of bifacial tools in the collections coincides with a complete absence of debitage or other tool items, which is not unexpected, given the desire to obtain museum specimens for comparative purposes and the scientific milieu of the period, which emphasized culture-stratigraphic successions.

Of 74 measurable bifaces, handaxes predominated, followed by cleavers, picks and knives (Table 2). The average length of the bifaces was 128 mms and the average breadth was 79 mms, although there was some degree of variability in these dimensions (Table 2, Fig. 6). The knives and picks were the largest items in length, with the least variability in size attributes; whereas handaxes had the greatest standard deviations in length and breadth, with both small and large items present (Table 2, 3). The length to breadth variation is lowest for cleavers which tend to be wide. These trends may, in part, be related to the primary form, as picks are mostly made from flakes, both knives are on cobble/boulders, whereas handaxes are made on a variety of clast types, and cleavers are made on large and

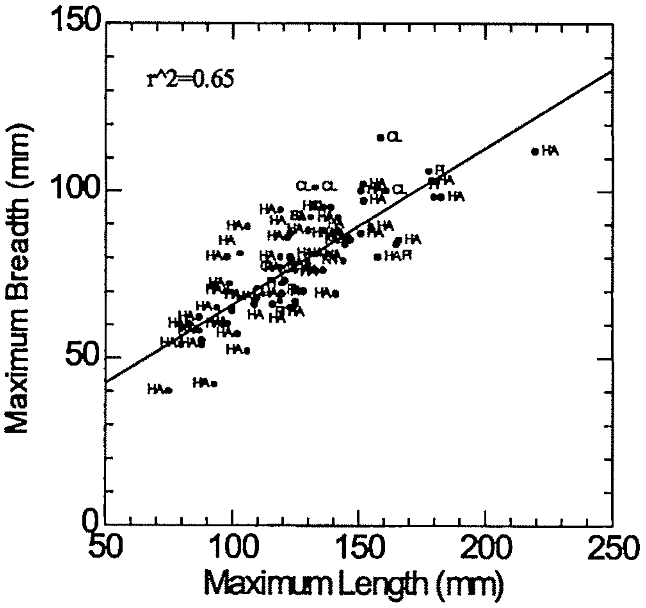

Fig. 6: Length and breadth of Smithsonian bifaces, H handaxe, CL = cleaver

Table 3: Descriptive statistics for form-defining ratios of biface collection

Type	Breadth/Length (B/L)			Thickness/Breadth (T/B)			Breadth1/Breadth3 (B1/B3)		
	Mean	SD	CV	Mean	SD	CV	Mean	SD	CV
Cleaver	0.68	0.07	0.10	0.47	0.11	0.24	1.31	0.26	0.20
Handaxe	0.63	0.084	0.14	0.50	0.13	0.26	0.71	0.14	0.20
Knife	0.57	0.03	0.05	0.68	0.08	0.12	0.61	0.09	0.14
Pick	0.56	0.03	0.06	0.63	0.05	0.08	0.68	0.08	0.12
Total	0.62	0.08	0.13	0.50	0.12	0.24	0.70	0.14	0.20

Table 4: Table of primary form of bifaces

Type	Flake	Cobble/Boulder	Indet	Total
Cleaver	8 (089)	0 (0.00)	1 (0.11)	9
Handaxe	18 (0.33)	10 (0.18)	27 (0.49)	55
Knife	0 (0.00)	2 (1.00)	0 (0.00)	2
Pick	7 (0.88)	1 (0.22)	0 (0.00)	8
Total	33 (0.45)	13 (0.18)	28 (0.38)	74

wide flakes (Table 4). The majority of the bifaces had from 10-34 negative flake scar counts, with a generally high average of 18 flakes per biface (Table 5, Figure 7). The cleavers tended to be the most flaked pieces, indicative of heavy trimming on both sides of these primary flake forms. The high retouch frequency, the shaping attributes, and the similarity to forms from the eastern part of Peninsular India (Pappu 1996b), correspond with soft hammer manufacture characteristic of the late Acheulian stage (Misra 1987).

As is the general trend for Acheulian assemblages in India (Misra 1987), quartzite predominates the Smithsonian collection, 99% of the bifaces made from this raw material. The quartzites vary considerably, however, some showing a bonded, homogeneous crystalline structure, and others being much more friable and subject to more weathering. Identification of quartzite variation is an important since raw material comparisons have shown relations between clast types and dimensions, mineralogical attributes, and tool characteristics (Petraglia 1998; Petraglia *et al.* 2001b). Researchers have observed that where quartzites predominate, tools tend to have greater dissimilarities in shape and less pronounced retouch (e.g. Murty 1966; Misra 1971; Alam 1990; Pappu 2001b), although this remains to be demonstrated. In comparison to other Late Acheulian sites in South India, there are some interesting parallels in quartzite handaxes and divergences with other raw materials. For instance, the average length of quartzite handaxes in the Smithsonian collection is 12 cms, and 11 cms for the Malaprabha Valley (Petraglia *et al.* 2001b) and 12 cms for the Gunjana assemblages (Raju 1988); in contrast, the Hunsgi Valley limestone handaxes average 16 cms (Paddayya and Petraglia 1993). The number of flake scar counts on quartzite handaxes is nearly identical between valleys, with 18.6/biface for the Malaprabha Valley and 18.4/biface for the Smithsonian collection. Given these observations, research on raw

Table. 5: Flake scar counts on large cutting tools from biface collection

Type	n	Dorsal Scar Count			Ventral Scar Count			Total Scar Count		
		Mean	SD	CV	Mean	SD	CV	Mean	SD	CV
Cleaver	9	12.11	3.82	0.32	10.00	4.56	0.46	22.11	7.90	0.36
Handaxe	53	10.25	3.87	0.38	8.62	3.25	0.38	18.87	6.58	0.35
Knife	2	4.50	0.71	0.16	5.50	0.71	0.13	10.00	0.00	0.00
Pick	8	8.25	4.27	0.52	5.25	2.92	0.56	13.50	6.55	0.49
Total	72	10.10	4.03	0.40	8.33	3.55	0.43	18.43	7.04	0.38

materials and artefacts would likely be fruitful in showing precise degrees of variation and the relative influence on stone tool flaking strategies and tool morphology.

An interesting observation is that some of the pieces take into account petrofabric attributes as demonstrated at the Isampur Quarry (Petraglia *et al.* 1999). Cleavers in the Smithsonian data set are made on flakes (Table 4) corresponding with the Isampur Quarry manufacturing strategy. However, the Smithsonian data set shows that bifaces are made on a variety of clast types, including probably cobbles and boulders, whereas the handaxes at Isampur tend to be made on slabs. These observations show that future research into the lithic technology, together with a modern approach to these contexts, may provide fruitful discussions about hominid behaviour in South Asia.

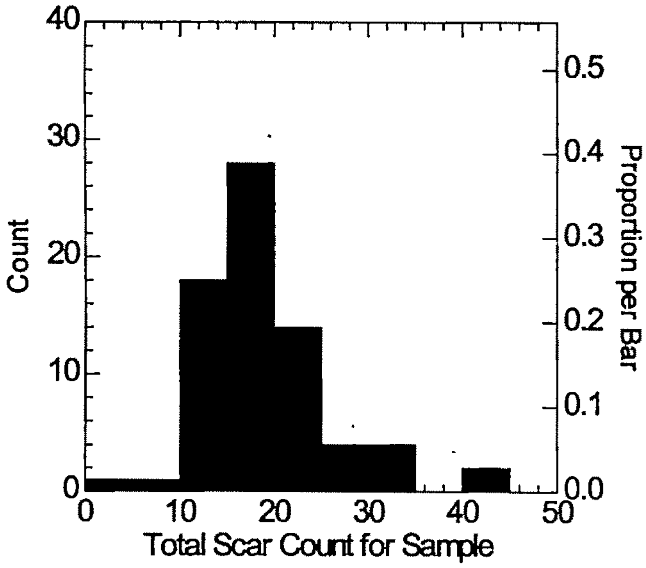

Fig. 7: Flake scar count range for the Smithsonian bifaces

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Geomorphological Observations at and around Kelshi, Konkan Coast, Maharashtra

Sushama G. Deo, Savita Ghate[1], Arati Deshpande-Mukherjee and P.P. Joglekar

Department of Archaeology
Deccan College
Pune 411 006

1 Dr. Ambedkar College of Arts and Commerce,
Jaijawan Nagar, Yerawda,
Pune 411 006

Abstract

Geomorphologically Konkan coast is characterized by pocket beaches and rocky headlands. There are two sand dunes at Kelshi, one of which is active and the other stabilized. The old dune at Kelshi is important, as it has preserved an archaeological site. The average height of the old dune is about 18 m. This paper aims to give preliminary geomorphic observations around the study region. Sedimentological analysis of samples collected from a geological trench is presented. The trench revealed the presence of platform-like layers of lateritic rubble.

Introduction

The Konkan coastline has preserved distinct geomorphic features, the study of which reveals the responses to dynamic environmental changes in the area. The Kelshi and Velas coastal regions (Fig. 1) are very interesting from this point of view. Several geomorphic features like the old and the new sand dune, creek environment, pocket beach and rocky coast can be observed here. The occurrence of sand dunes is not common along the Konkan coast. Karlekar (personal communication) reported the presence of an old sand dune at Kelshi. Ghatpande (1993) carried out a detailed geomorphic and sedimentological analysis at this dune. Based on these results she described this dune as aeolian and classified it as an old lithified dune. At Kelshi, archaeological material occurs in the sand (Joshi 2001). Joglekar *et al.* (1997) reported the faunal remains (bones and shells) collected from the site of Kelshi. Based on comparison of topographic map and IRS 1B image, Karlekar (1999-2000) reported significant changes in the morphology of the Kelshi creek system.

Importance of Dune Studies

There are many factors controlling dune development such as sediment type, the nature of sediment supply, the presence of winds above the sediment entrainment threshold and vegetation capable of initial stabilization. The source of sand for any dune field is the sandy beach that bounds the dune field on the seaward side. Sand is blown off the beach into the dune field by the onshore-directed dominant wind. Other more local factors include topography, the nature of the wave climate, the tidal range, presence of tidal litter and, the course of sea level, over a long duration (Carter 1988).

Formation of any coastal sand dune is the result of complex processes involving delivery of marine sand to the beach from the nearshore by waves, exposure of this sand to the air, its drying and entrainment by the wind. This "handover" process is exceedingly variable, depending for its efficiency on the smooth mixture of two different process systems. In this process, vegetation plays an important role as trapping agent for air lifted sand. It is essential to have interaction between wind and vegetation for dune growth. Sand dunes act as a buffer to extreme waves and winds. The constant, temporally asymmetric sediment exchange between beach and dune is an important natural process for maintaining both morphological stability and ecological diversity. It should not be artificially disturbed. In addition to absorbing wave attack, the dunes shelter landward communities, and assist in the retention of freshwater tables against salt water intrusion. Therefore they form an important feature of coastal geomorphology. The study of such dunes could generate significant information about the dynamics of changes on the coast, particularly during the Holocene, and provide a base for archaeological interpretation. Hence, considering the geomorphic and archaeological significance of the dune, in March 2001, we carried out fieldwork in the area around Kelshi and Velas. This paper presents these preliminary geomorphic observations with a view to examine importance of geomorphic processes in the evolution of sand dune fields in relation to archaeology. Here an attempt has been made to give a geomorphic history of the dune by using both geomorphic and archaeological evidence, which would be useful in establishing the age of Holocene coastal deposits.

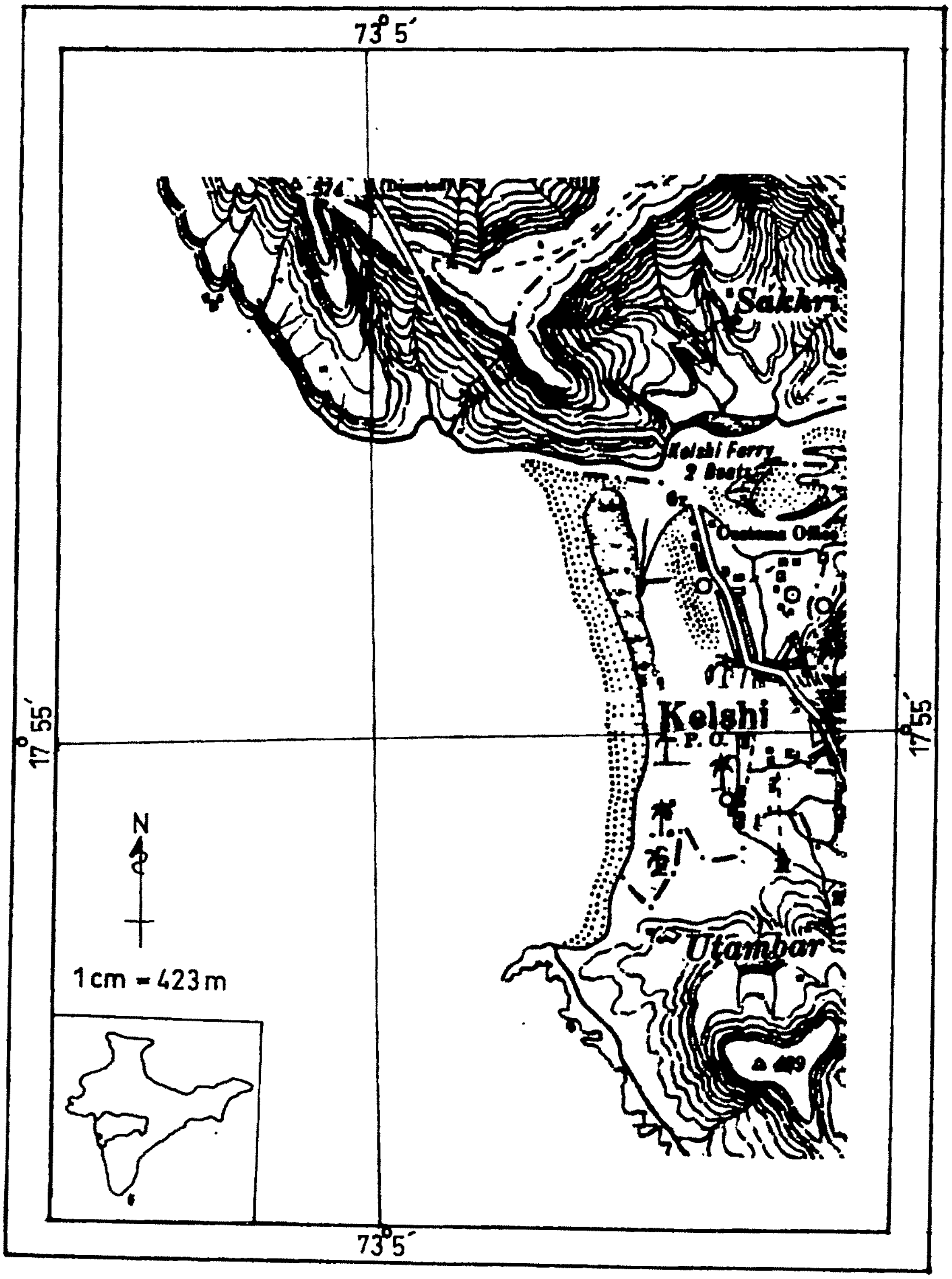

Fig. 1: Map showing location of Kelshi

Environmental Setting

Kelshi (73° 3’ N; 17° 6’ E) is situated in taluka Dapoli, District Ratnagiri (Fig. 1). It is located on the mouth of a very small estuary Bharja. An estuary is semi-enclosed water body connected to the sea, within which seawater is measurably diluted by fresh water (Cameron and Pritchard 1963) and tend to be tide-dominated. The stream is swift and non-perennial. This estuary covers an area of about

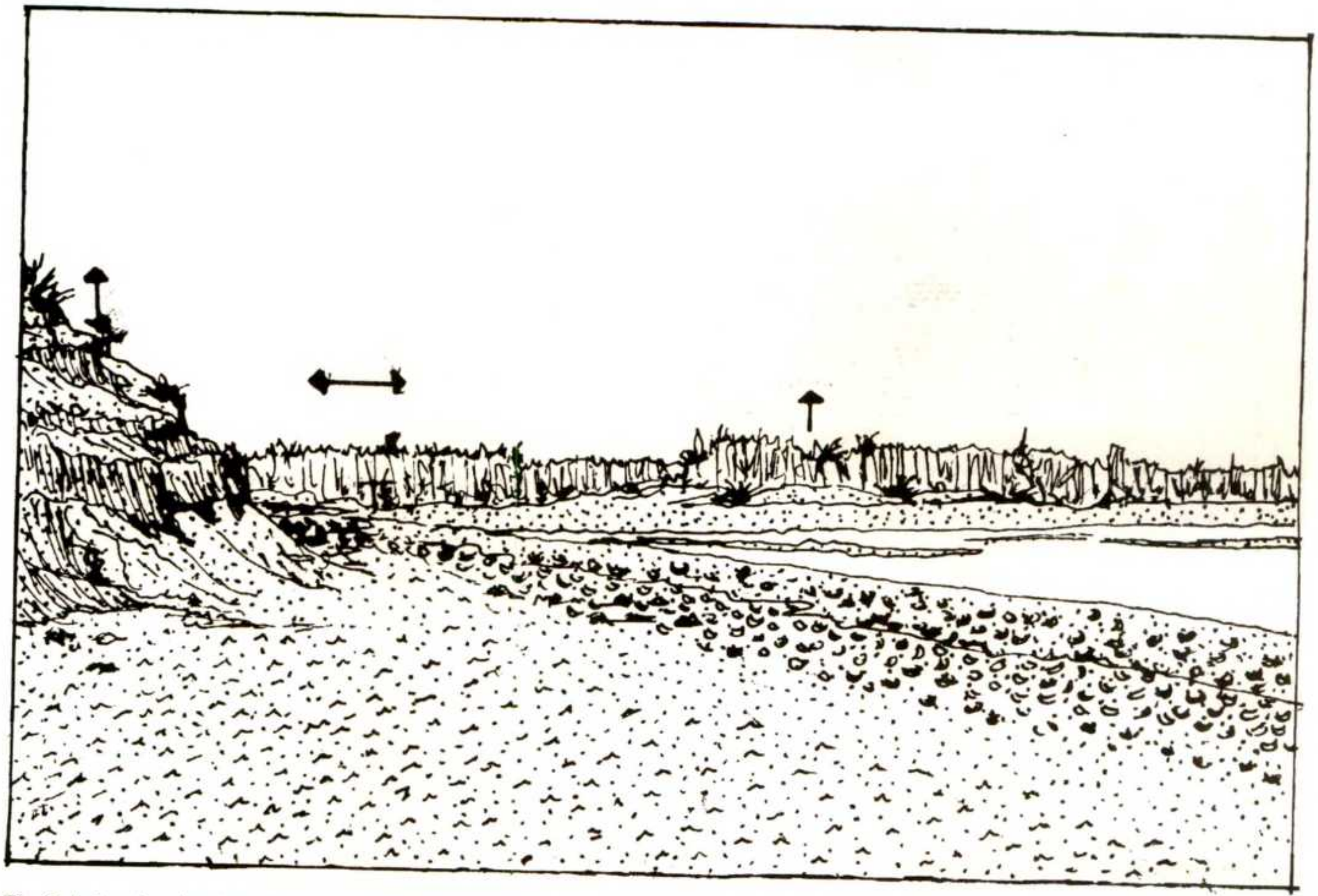

Fig. 2: A drawing showing alignment of the old dune face and present pocket beach (view from north)

6 km^2. It runs for a distance of 3 km inland. There are a number of small streams running for less than one km of which more join the estuary on its northern bank as compared to the southern bank. Narrow and elongated terraces border the estuary. This area receives heavy monsoon rainfall. All the streams have more water during the monsoon season. The tidal environment is of mesotidal type. Semidiurnal types of tides are recorded and waves are generally moderate to low on this coast (Indian Tide Table 1989). Only during the monsoon season waves are high and destructive.

The topography of the surrounding region is characterised by moderate relief. There is a small pocket beach on the coast of Kelshi. This beach is located between two rocky headlands. The northern side is bounded by the Dighi hill which is the highest point with an altitude of 190 m AMSL. The southern side has the Utambar hill. The old dune is located in an estuarine environment having a somewhat "hybrid" environment incorporating terrestrial and marine dynamics. The old dune is 150 m away from the presently active dune formed on the present pocket beach (Fig. 2). This dune is newer than the one earlier mentioned having archaeological deposit (old), and is active at present.

Dimensions of the Dune

Of all the coastal features, sand dunes have suffered the greatest degree of human pressure. Many dune systems have been constantly altered by human activity, both by accident and design. Almost all dunes have undergone some degree of post-depositional modifications. These modifications may be extensive, obliterating all trace of earlier forms and structures, or far more localized, giving rise to a complex pattern of old and new dunes. Post-depositional modification may involve physical (slumping, compactions), chemical (oxidation, leaching, calcification), and biological (reactivation, humification) effects, leading to soil formation, lithification (Carter 1988). At Kelshi too, some degree of destruction is visible in some parts although the original structure is more or less preserved. Habitational layers can be seen well preserved on the northern face of the dune. The Gazetteer (1962) mentions that a yearly fair is held at Kelshi in the month of *Chaitra*, which is attended by about 25,000 people. Local people

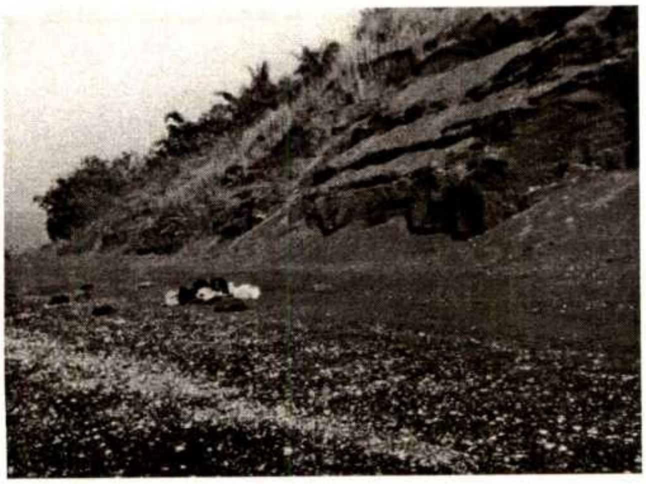

Fig. 3: The face of old dune (view from north-west) showing molluscan shell lag on the foreground. Four platform-like laterite rubble layers are visible in the section

informed us that during this fair some areas of the dune get disturbed.

We measured the dune and our measurements were found to be matching with those given by Ghatpande (1993). The dune is shown by a 50-foot contour on the one inch Survey of India Topographic Sheet. It is triangular in shape and stretches 560 m from north to south. The average height is 18 m and the highest point (32.4 m) is located on the northern part of the dune. The western face of the dune has a convex slope and the landward face is a steeply sloping. Ripple marks are present over most of the dune surface. Vegetation is more abundant on the southern side compared to the northern side. The eastern face is devoid of any vegetation. The eastern slope directly merges with the flat terrace on the landward side. At many places sand fans created by moving sand are seen. The location of Kelshi dune is such that at present it is away from the open sea environment. This dune is isolated from the active dunes by a tidal channel. During high tide, this old dune can only be approached from its landward side because the active dunes are completely under water. As a result of this, the old dune is completely cut off from the present beach. The old beach facing the dune has preserved a shell lag (Fig. 3).

Nature of the Old Dune at Kelshi

We cut a geological trench of 9 meters on the dune. It was located 49 m from the landward edge of the dune and faces the north (Dighi hills and estuarine channel). It is approximately 3 m above the present sea level. From this section sediment samples were collected at various intervals. Sample numbers 1-7 were at 20 cm interval from the base of the dune and remaining samples (nos. 8-20) at 50 cm interval (Fig. 4).

The section shows two distinct layers on the basis of colour. The first layer is at the base and made of compact blackish sand. The second layer is of yellowish sand. The base of the dune is sand flat with perfectly horizontal bedding. The sand flat is characterized by a smooth surface having a low gradient. The sand flat over which dune is located is very interesting as the sand flat occurs where waves get weakened. It indicates a sluggish water environment. Normally it is found in the heads of open bays, behind islands, or at the inner margins of extensive shallows on which waves die out. The loss of energy enables the sand to be deposited in the shallows. However it is difficult to explain why waves should not transport sand shoreward and generate a normal profile.

From the section it is clear that cultural material starts at 1 m above the present sea level. Interestingly, the dune has preserved horizontally bedded layers in between the cultural horizons. These layers are nothing but laterite rubble platforms of varying thickness (4 to 6 cm). Five such platform-like rubble layers can be seen from the section occurring at 4.0, 4.6, 4.84, 5.0, 6.0, and 7.0 m height from the base of the dune. Besides this the middle part of the north-facing dune has preserved nine rubble layers. The presence of such layers of laterite in between the cultural horizons indicate that the site was occupied only seasonally, and abandoned regularly. The site could have been occupied for seasonal trade activity. Geomorphologically, these platform-like features indicate that dune must have had a fairly consolidated sand structure over which they were made. Also it is observed from the section and elsewhere from the dune that the distance between two platform-like layers varies. It suggests that sand accumulation between two occupation periods is not uniform. Also some platform-like layers are quite close to each other. From 3.10 m onwards, horizontally bedded shell layers are present. There are 5 layers of shells at varying intervals. In the section a number of pottery pieces, animal bones and molluscan shells were found. Preliminary observations of the archaeological remains suggest those to be of Early Historic to the Medieval period.

Sedimentological analysis of samples was carried out to find out the characteristics of the dune. Basically these samples are sand dominated with variation from very coarse sand to very fine sand and coarse silt. It further shows that there are some parts that are completely devoid of cultural material. The basal part of the dune (up to 2.5 m: sample nos. 1-2) and the middle part (from 5.0 to 6.5 m: sample nos. 10-14) are devoid of any habitational deposit and also shells. The analysis of these samples indicates sediment size variation for samples with and without cultural material. Of the samples which are devoid of any cultural material, 60% are in the size range of 3 to 3.3 phi indicating very fine sand. The remaining samples are in the fraction of 2.75 phi indicating fine sand. On the

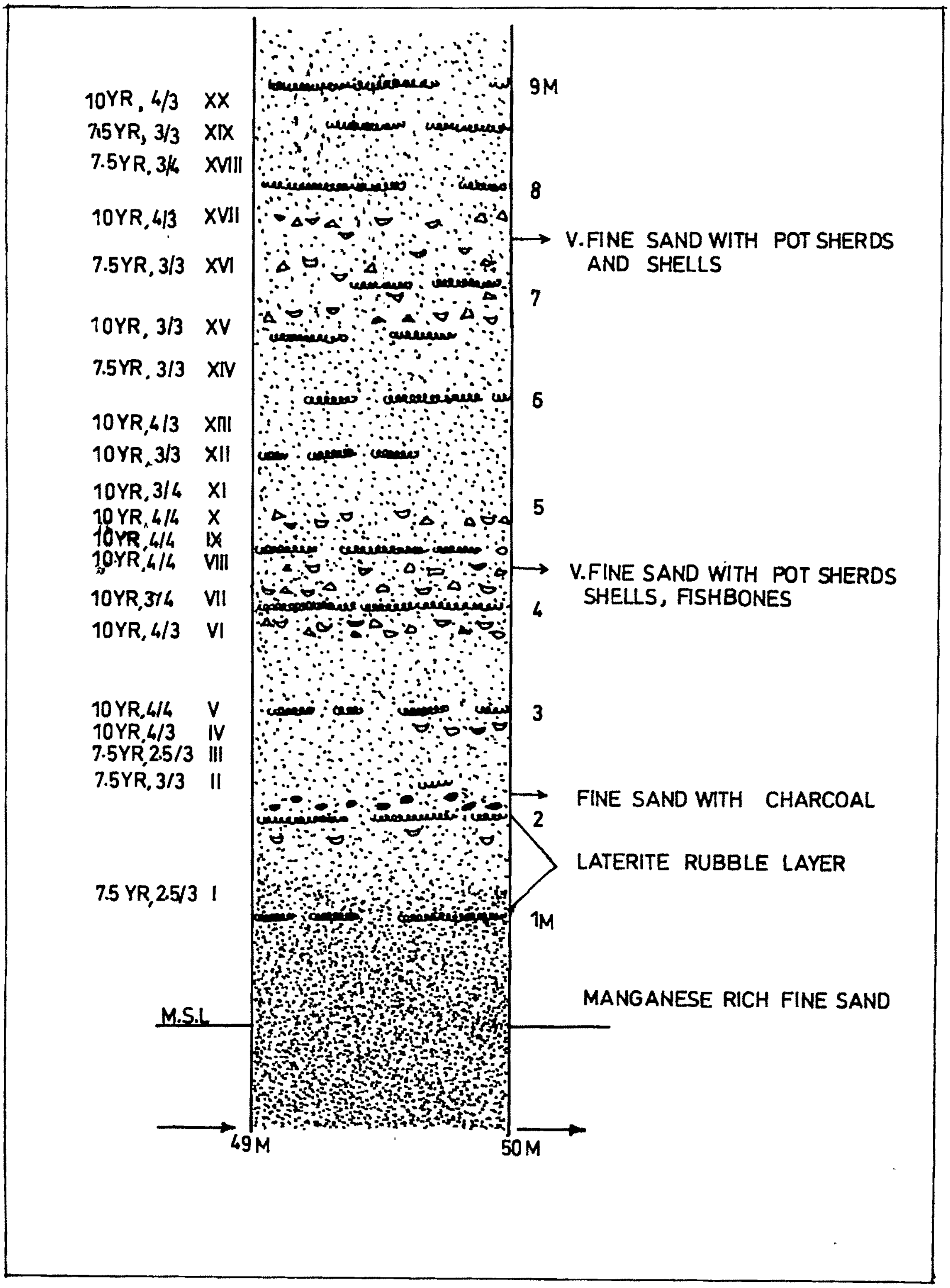

Fig. 4: Old dune at Kelshi : strategraphic sequence

other hand of the samples with cultural material, 24% belong to very fine sand class and 14% to fine sand class (Fig. 4).

The source of sand for any dune is the sandy beach that normally bounds the dune on the seaward side. The sand from the beach is blown off into the dune by the onshore-directed dominant wind. At Kelshi the dune is situated on the landward side and totally cut-off from the present-day active beach. It suggests that during the past the open sea must be very near to this old dune with a sandy beach. Perhaps there was little higher sea level in the past or some changes in the configuration of the surrounding area have occurred. Possibly due to the receding/ lowering of the sea level the beach was abandoned and dune was stabilized.

Velas Coast

Velas village is situated to the north of Kelshi and the two are separated by the Dighi hill (Fig. 1). It has a small beach sloping steeply and a dune is located on the beach. Morphologically this dune is different from the active dune at Kelshi. The height of this dune is about 3 m AASL. It is in the form of three terraces. Each terrace is about 2 m high and 5 to 6 m wide. There is a sandbar developed due to the obstruction of the Dighi hill. The beach and the dune are parallel to this sand bar. It appears that both beach and the dune are not to be very old and could be of mid-Holocene in age.

Concluding Remarks

As noted earlier the preliminary observations made at and around Kelshi provide data about geomorphic changes in relation to formation of the coastal dune. Ghatpande (1993) considered the old dune has been lithified. However, the layers that look lithified, are actually man-made features. Further study of occupational material recovered from the old dune at Kelshi would throw light on additional factors governing formation and destruction of the coastal dune.

Acknowledgements

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A Review of Archaeological Exploration in Dhule District — The Stone Age and Chalcolithic Phases

S.A. Sali*

Abstract

A review of the Prehistory of Dhule District, based on village-to-village survey is given in this paper. The prehistoric sequence in Dhule District includes a number of phases of Lower Palaeolithic (Early Stone Age), Middle Palaeolithic, Upper Palaeolithic and Chalcolithic. The Quaternary sequence has been divided into six separate phases of deposition, with a number of unconformities. Chalcolithic cultures include the Savalda, Late Harappan and Jorwe of which the Savalda has been first recognized from the Tapi basin.

Introduction

Since the publication of "An Outline of Archaeological Evidence from Dhule District" (Sali 1962), by this author fresh data, particularly in respect of the Stone Age and the Chalcolithic phases, have been obtained in the course of further exploration undertaken by him in the District. In the light of these it is proposed to review in this paper the results of his explorations in the region.

With the confirmation of the Chalcolithic nature of the site at Jorwe (Sankalia and Deo 1955) on river Pravara near Sangamner (District Ahmednagar), which was the first site of the Chalcolithic complex to be discovered in the Northern Deccan in 1950 and through excavations at Nasik on the river Godavari (Sankalia and Deo 1955) and at Bahal on the Girna, the cultural history of this region was pushed back by more than one thousand years. This was followed by the discovery of several post-Harappan Chalcolithic sites in the Northern Deccan and Central India of which Prakash (IAR 1954-55: 13) and Nevasa (Sankalia *et al.* 1960) in the former and Nagda (IAR 1955-56: 11-19), Maheshwar (Sankalia *et al.* 1958), Navdatoli (Sankalia *et al.* 1958) and Tripuri (Dikshit 1955), in the latter were subjected to excavation. Many sites with Harappan and post-Harappan remains were brought to light in the adjoining Gujarat (Rao 1963) region. In Southern Deccan at Brahmagiri (Wheeler 1947-48: 180-302), Sanganakallu (Subbarao 1948) and Maski (Thapar 1957) likewise, Chalcolithic and Neolithic remains were excavated. The above discoveries of post-Harappan Chalcolithic cultures in such distant areas posed several problems particularly of their origin, contact and correlation. It was also observed that a time-gap existed between the Chalcolithic and the overlying iron using culture, suggesting thereby a sudden disappearance of the Chalcolithic people from the scene. With a view, therefore, to obtaining clues, which would help throw light on the above problems, a thorough exploration on regional basis was undertaken.

Besides the Chalcolithic and allied cultures, the Stone Age cultures also needed a thorough scrutiny, region-wise, so as to evaluate their characters vis-à-vis those from other areas in the country.

The author had an occasion to undertake a detailed survey of the Dhule District in the last three years. While this author was assigned the work in the Dhule District, similar investigations were also carried out in the Ahmednagar District in the Northern Deccan, Bijapur and Dharwar in the Southern Deccan, thus covering parts of the Narmada, Tapi, Godavari-Pravara, Krishna and Tungabhadra valleys as part of a plan for the survey of antiquarian remains undertaken by the A.S.I. During the course of this work a substantial material on the Stone Age and Chalcolithic cultures of the District was collected and it is proposed to review it in the present paper. This kind of small regional study may, it is hoped, help in solving the problems mentioned above.

Physiography and Geology of the District

Physical Features

Lying as it does in the Tapi valley, "a transitional zone between Central India and the Deccan' (Spate 1960), and square in shape, the District of Dhule (previously known as West Khandesh, renamed as Dhule in 1960) with the District headquarters of the same name (20^0 40' to 22^0 00' N; 73^0 40' to 75^0 00' E) covers a total area of approximately 13,986 km^2 (District Census Handbook, West Khandesh, based on the 1951 Census).

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* This article was finished by the author but remained unpublished After Dr. Sali's death, it was handed over by his son to the editorial committee. The committee decided to publish it so that his observations will not go unnoticed and tried to make it as complete as possible.

Physiographically, the region can be divided into three distinct zones: the northern belt comprising the Satpura hills, the central Tapi plain, and the southern hilly tract including the Nizampur plateau. The northern hilly region having an elevation of nearly 900 m. slopes towards the south and "is essentially a region of poorer forest type, inferior agriculture, thin population and general backwardness" (Statistical Atlas of Bombay State 1950). It is dissected by numerous streams, the majority of which drain into the Narmada in the north. Among these are the Devaganga and the Udai rivers and the Khat and the Sambar *nalas*. The Gomai, Arunavati and Aner rivers, and the Vaki, the Khadi, the Mhais and the Susari *nalas*, which rise in the Satpura hills are the northern tributaries of the Tapi.

The Tapi plain is mostly filled with the river alluvium. It is a fertile tract and holds the maximum population of the District. In Nandurbar taluka, it is traversed by numerous dolerite dykes having east west, northeast-southwest and rarely north-south trends which form low, stony ridges bearing scanty vegetation. These dyke hills are further cut through by several small streams which run towards the north into the Tapi, with the result that these bouldery outcrops of dykes stand out conspicuously in this otherwise plain tract. Some of these dykes intersect each other forming a valley on either side of the intersection. The valleys thus formed at Kokni Pada and Umajacha Pada in the Ranka nala basin seem to have been occupied by the Stone Age man. The Tapi in this region receives on its south the rivers Panjhra, Buray, Amravati, Shivnad, Nesu and Rangavali, and a large number of nalas including the Ranka, Patalganga and Sukar.

The Nizampur plateau, which in fact is an extension of the Malegaon plateau, with high escarpments on the west and a mild tilt towards east, has three main river valleys of the Buray, Kan and Panjhra. The Panjhra river is bordered on the south by the steep northern face of the Galna hills and the bare Laling hills. It flows towards east up to Dhule and then takes almost a right angle turn towards north to meet the Tapi. The jungle-clad hilly Navapur in the west region slopes to the west-northwest and contains two main river valleys of the Nesu and Rangali. It is interesting to note that the region south of the Tapi has a radial drainage pattern and abrupt northward and northeast ward turn of the easterly flowing rivers and *nalas* in this region which seems to have taken place due to the titling of the whole landform towards north and northeast approximately along the line joining Dhule city and the Lonkheda and Ashta villages.

Geology

This area is chiefly underlain by the Deccan Trappe lavas with a few isolated patches of other geological formations. (Memoirs of the Geological Survey of India 1869: 163, 345, 350).

The region south of the Tapi is composed of a number of lava flows of varied thickness. Though generally horizontally laid, at places the sheets or beds are seen dipping at small angles. In the bed of a small *nala*, between the village Nagaon and the Tisi railway station in the Tapi plain, a mild fold was observed in the bed of trap. Varieties of trap are found in the region. Intertrappean beds of siliceous tuff have been noticed in the Ranka basin while a lump of chert with microfossils found in the Panjhra bed in Dhule suggests the presence of an intertrappean bed also in the Panjhra valley. A specimen of shale with fossil plant remains of "some Cretaceous pteridophytae" (Mahajan personal communication) collected at Pechribari Pada deserves mention. Water-worn pebbles of quartzite are found in the gravel bed of Tapi. Their source appears to be far upstream beyond the limits of this District.

The Tapi plain in the Nandurbar taluka is marked by a swam of dykes. In the examined area they vary in breadth from 30 cm to over 10 m and can be traced for long distances. The longest dyke so far observed by the author is in the Deomogara forest, west of Umaj. It follows the southern periphery of Nandurbar town and runs towards east beyond Ranala, covering a distance of about 50 km. In the southern hilly region also a large number of dykes were observed. Their orientation was more are less same as that of the dykes in the Tapi plain mentioned above. On the way to Dhadgaon from Shahada the author has noted more than half a dozen dykes in the northern mountainous belt of the Satpura. The hot spring at Anakdeo is very close to one of them. The hot spring at Indva on the southeastern border of the Nandurbar area also deserves mention.

The latest geological formations in this District are represented by the alluvial deposits consisting of gravels, sands, silts and clays and calcareous tufa which filled the river and *nala* basins and in which are found the relics of the Stone Age man, including lithic artefacts and animal fossils. The gravels, of various grades from coarse to fine, show varied degrees of compactness. Current-bedding is common wherever they are composed of fine grade. Lamination is very clear in the massive deposits (over 15 m) of sand at Jharali Pada in the Shivnad basin. The thickness of the gravel beds, in general, varies from 30 cm to 3 m. The clays are red, brown, chocolate and purple in colour, while the silts are light brown, yellow and grey and their shades. These fine sediments vary in thickness from 30 cm to 6 m. In the Tapi basin, however, the silts vary from 2 m to 15 m in thickness. The clays and silts contain calcrete nodules of various dimensions from pellet-sized to fist-sized and even larger. Occasionally, calcrete sheets are also found. Fossil plant remains have been found in loose calcareous blocks at Amoda and also in fine sandy deposit at Bhandgaon in the Kan basin and in the silt at Takartala in the Shivnad basin.

Calcareous tufa has been noticed at Amoda and Yesar on the river Kan and in quite an extensive area between Pechribari Pada and Kothli in the Ranka valley.

Dark brown or black soil on the top of the exposed alluvial deposit in the cliff-sections on the banks of the rivers and *nalas*. Heavy erosion has removed this soil from a considerable area from the bank of the Tapi. But in the Tapi plain, away from the banks, the black cotton soil (regur) is seen developed on the weathered basalt. Elsewhere, this soil can be seen at the base of the hills and in the depressions. In the Deomogra forest, this soil has been found on the top of and slopes of hills, the vegetation cover protecting it from erosion. On the top and slopes of bare hills a thin cover of red and light red or pink soils is met with. In the high altitude hilly western part of Sakri taluka, with annual rainfall between 12 and 20 cm, in the upper Panjhra, Kan and Buray valleys, reddish ferruginous soil is formed over the basalt. At places black and yellowish or pinkish yellow soils are also noticed.

Two fossil soil beds have so far been noticed in the District, the one formed during the period of transition form the Early Stone Age to the Middle Stone Age and the other from the Late Middle Stone Age to the Late Stone Age, the latter observed only in the Buray basin.

Recent sand dune formations have been noticed on the south bank of the Tapi at two places, one between Sulvada and Vyaval and the other between Anturli and the Nandurbar-Taloda road behind the Government Grain Depots at Shajipur (locally pronounced as Sajjipur). The dunes, over 3 m high at the crest are occupying more and more arable land each year and their expansion activity has been observed to be intensified in the hot season, particularly in the month of May.

The earthquake which occurred on the 14th March, 1938 with its epicentre at Lat. 21^0 31' N. and Long. 75^0 50' E., about 115 km north-east of Dhule, is said to have changed underground water levels of the region (Maharashtra Jilla, Jalgaon, Publications Division of Government of Maharashtra, p. 26).

Climate

The climate of the District is same as that observed in Western India. Except during the monsoon the climate of the District is generally dry. Summer is the driest part of the year. The hot season begins in March and lasts till the onset of the monsoon, i.e., till the first week of June. May is the hottest month when temperatures are everywhere high. Dust storms are common in the month of May. With the onset of the south-west monsoon, the temperatures drop appreciably and in general this period, lasting up to September is pleasant. From west to east there is a marked decrease in the rainfall. The hilly western part of Navapur receives more than 50 inches (125 cm). The eastern part of Navapur, the western parts of Sakri, Nandurbar, Akrani, Taloda and Akkalkuwa talukas receive annual rainfall between 30 and 50 inches (between 75 and 125 cm). The central part of Sakri, eastern parts of Nandurbar and Akrani and the western part of Shahada receive between 25 and 30 inches (between 10 and 12 cm) while the rest on the east receives 25 inches (10 cm) and less. With the withdrawal of monsoon, day temperatures rise a little in October and by November both day and night temperatures begin to drop.

December and the early part of January are the coldest periods in the District. Cold waves, which pass over North India sometimes, affect the District and at times in some parts of the region minimum temperature may drop to even freezing point of water.

Khandesh: Its History, People and Culture

The District of Dhule is the western part of what was formerly called Khandesh. Prof. V. V. Mirashi identifies Khandesh with the ancient Rsika (Mirashi 1944). During the times of the Yadava the name of Khandesh was Sevana, i. e., Seuna-desa (Sircar 1960) and it became known as Khandesh perhaps during the Muslim rule.

As will be seen in this paper, this part of India has been inhabited from the earliest period of human history. The excavation at Prakash showed that a full-fledged iron-using culture during the 5th to 1st century B.C. (IAR 1954-55: 13). The occurrence of sherds of the N.B.P. ware ascribable to the later part of this period is noteworthy since it indicates intercourse with sites of similar date in the Ganga-Yamuna doab (IAR 1954-55: 13). The solitary silver punch-marked coin found by this author at village Khairwa not very far from the ancient site at Shala yielding black-and-red ware of the iron-using culture, may also be attributed to this period. Satakarni I (c. 194-185 B.C.), who assumed the title of Dakshinapatha-pati, is said to have conquered Western Malwa and the territory to the south of it including Anupa and Vidarbha. This would suggest that in the 2nd century B.C., the area was under the early Satavahana kings. The period from about 1st century B.C. to 4th century A.D. at Prakashe was marked by the presence of Red polished ware in the well-known sprinkler form (IAR 1954-55: 13). The presence of this ware at Prakashe and at other sites, viz. Thalner, Korat, Vyaval, Kothali and Nasarpur shows that this part of the country had contacts with the Roman world perhaps by way of trade. After the Satavahanas the region was ruled, between 3rd century A.D. and about the end of the 13 century A.D., successively by the Abhiras, Vakatakas, Trikutakas and Kalachuris, Rashtrakutas and Yadavas. Under the Yadavas the region was quite prosperous as is indicated by the remains of numerous temples and sculptures of that period found by the author. From 14th century, this part of the country was under the Muslim rule till about the middle of 18th century when it was ceded to Balaji Peshwa.

As the Satavahanas had patronized Buddhism, it is quite likely that under their rule, a bulk of population might have been Buddhist. After the decline of Buddhism, as in other parts of India, Buddhism must have suffered a setback in this region also. During c. 2nd-3rd century A. D. some people following the typical South Indian Megalithic burial ritual seem to be present in the region as is indicated by the discovery of a pit-burial containing typical megalithic pottery at Ranjala. The remains of Hindu temples at a number of places in the District, ascribable to the Yadava period (c. 12th-13th century A.D.) amply demonstrate that Hinduism held sway during this rule. Even during the succeeding rulers- the Muslims- the religious cores remained unaffected. During the 12th-13th century A.D. Jainism was also quite prominent in the region as is judged from the rock-cut caves at Mohida-Tarf-Haveli (IAR 1958-59: 71) and temple ruins and sculptures, some of them re-inscribed, at Sultanpur and several other places in the District.

Although in essence, the culture of this District is the same as that of any other part of India and especially of Maharashtra, it has certain distinctive features such as the language and social and religious traditions. "The principal language of the District is... a form of speech which shares some of the characteristic features of Gujarati and in others agrees with Marathi. It is sometimes simply called Khandeshi, i.e., the language of Khandesh. Another name is Ahirani, i.e., the language of the Ahirs or cow-herds, a name which is also reported from other parts of India" (Grierson 1907). Among the distinctive social and religious traditions are the festivals of Rot or Kanbai and Bhaldev, which, as far as the author knows, have no parallels in any other parts of the country.

Stone Age Evidence

Introduction

Intensive explorations in the form of village-to-village survey were carried out in the talukas of Nandurbar and Sakri. Small portions in the Shirpur, Sindkheda and Shahada talukas and the area around the town of Dhule were also explored. The result was that several Stone Age, Chalcolithic and Historic sites, a couple of sites yielding Megalithic type pottery, a large number of temple remains and sculptures and some caves and inscriptions were discovered (IAR 1957-58: 24, 71; 1959-60: 33-34; 1960-61: 26; 1961-62: 32; 1962-63: 15). The evidence relating to the Stone Age and the Chalcolithic is dealt with in this paper.

Stone Age artefacts are known from the Pravara-Godavari and the Narmada valleys and hence it was not unreasonable that they should occur in the Tapi valley also. The discovery of several Middle Stone Age sites on the Tapi recently made by the staff of the Deccan College, Poona, has aptly proved this (IAR 1956-57: 11).

In the course of his exploration in the District till February 1996 the author discovered Stone Age tools at more than 250 sites in the examined areas of the basins of the Tapi, Shivnad, Amaravati, Buray, Kan and Panjhra rivers and their tributary *nalas* or streams notably Ranka, Patalganga, Sukar, Amaravati-Bhad and Pan or Gokul. These tools have been found *in situ* in the gravels, clays and silts and on the surface on the open campsites. Open camp sites of the Early Stone Age have been found in the valleys formed by the intersection of dykes, at the foot of hills and near the dykes which provided a plentiful supply of raw material for manufacturing the tools. It is interesting to note that on most of these sites the tools were associated with black soil. The Middle Stone Age sites have been noticed in large numbers on the open plains as compared to the hilly areas. From the evidence obtained so far it appears that the Late Middle Stone Age people also chose the open plains for settlements. Open campsites or 'factory sites' of the Late Stone Age, however, are found mostly on the top of river side hills.

Stratigraphy

The overall stratigraphic evidence obtained till 1961 (IAR 1957-58: 24; 1959-60: 33-34) in the examined courses of the rivers and *nalas* was that of four gravel sequences; the first gravel containing the Acheulian bifaces as at Amoda and Bhondgaon on the Kan, the second evolved Acheulian bifaces as in the Ranka basin at Umaj, the third blade-flake-scraper-point assemblages of the Middle Stone Age and the fourth Late Stone Age tools. Yet the picture of Stone Age stratigraphy as a whole is a complex one, because it was difficult to correlate properly all the deposits found in different rivers and *nalas* in the region and the place them in a proper generalized sequential order. Such a difficulty arose because of two main factors, *viz.*, first, calcretization in varied degrees of silts and clays changing considerably the physical character and the colours of these fine sediments, and second, the identical characteristics, such as current-bedding and red or reddish brown colour of various gravels of fine grade.

To overcome these difficulties, it was necessary to find cliff sections showing a sequence of much more clearly recognizable and representative alluvial deposits. Fortunately, in the course of an exploratory survey of the lower reaches of the river Kan around Bhadne and Yesar, the author came upon cliff sections which not only fulfilled this objective but also produced new information with regard to the sequence of cultures and the cyclic environmental conditions. The stratigraphic sequence of alluvial deposits found in the Kan basin is as follows (see Sali 1964-65) (from the bottom upwards):

1. Coarse to fine gravel resting upon the uneven surface of basalt (Early Stone Age).
2. Red calcareous clay.

   Unconformity
3. Coarse to fine gravel, partly re-deposited.
4. Chocolate brown or dark brown fissured clay showing soil characteristics.

   Unconformity
5. Current-bedded red sandy fine gravel (Middle Stone Age).
6. Brown clay-silt.
7. Current-bedded sandy fine gravel (Late Middle Stone Age).
8. Yellow silt.
9. Current-bedded sand and fine gravel (Microliths).
10. Brownish silt.

In the very heavily silted basins of the Pleistocene period, it is difficult to ascertain the position of the then existing channels. The sections exposed in the Kan basin which yielded Stone Age industries of different periods may well be a portion of an ancient meander in which were piled up sediments of huge dimensions. Interestingly enough a similar phenomenon has recently come to light in the foundation trenches taken at the dam site on the Mula river. Here also Stone Age artefacts have been found within the sand and clay beds.

Very recently the author has found in the upper Buray basin at and in the vicinity of Brahmanvel, a clear fossil soil bed, varying in thickness from about 20 cm to 40 cm, stratigraphically lying between the gravels corresponding the (7) and (9) above. In the same river basin the author has also come one more gravel bed which caps the grey silt, corresponding the (10) above, and underlies the dark brown to black soil. With these discoveries, the generalized stratigraphy of the Stone Age of the region given above can be modified as:

1. Coarse to fine gravel (hereafter called Gravel I).
2. Red Calcareous clay.

   Unconformity
3. Coarse to fine gravel, partly re-deposited (herein after called Gravel II).
4. Dark Chocolate brown fissured clay at places visually showing soil characteristic.

   Unconformity
5. Current-bedded red sandy fine gravel.
6. Brown clay-silt.
7. Current-bedded sandy fine gravel (herein after called Gravel IV).
8. Yellow calcareous silt at places with a band of blackish sand almost in the mid levels; fossil soil at and in the vicinity of Brahmanvel.
9. Current-bedded sand and fine gravel (herein after called Gravel V).
10. Grey or brownish grey-silt.
11. Brownish fine gravel (herein after called Gravel VI).
12. Black or dark brown soil.

The unconformity between the fourth and the fifth is much more marked than the one between the second and the third deposits. Archaeologically also this is brought out clearly, for the industries associated with the fifth and seventh gravel-sands are of the Middle Stone Age while those belonging to the first and third are of Early Stone Age. The break seen between second and third is not very conspicuous, if the faces of the sediments are considered. The material in the third contains a fair amount gravel derived from the first. What time gap is represented by the break between second and third layers can not be said with certainty but looking to the Acheulian industries which occur in both first and third deposits, this does not seem to be of a very long duration.

Cultural Evidence

The so far known earliest cultural phase, perhaps antedating the period of deposition of Gravel I, of the Stone Age man in the Tapi valley in Dhule District is represented by the large and thick flakes of trap with obtuse-angled plain striking platform, as in the Clactonian flakes, found on the open camp site at Kokni Pada in the Ranka *nala* basin and a similar type of solitary flake from Thane Pada in the basin of the river Amaravati. Together with this also seem to go the heavily rolled large and thick flake of trap of cleaver form recovered from the Gravel I at Yesar on the Kan, and the boldly flaked Abbevillean-type handaxe on a core of hard trap with a high hump on the upper side, fully flaked underside, wavy edge along half the periphery and the curved lower end picked up in the gravel bed of the Kan at Kirvada.

Gravel I at Bhondgaon on the Utavali *nala*, a feeder of the Kan, consisting of angular rock-waste, yielded Acheulian tools, including a triangular handaxe on a core with a thick butt-end and discoidal cores with wavy edges produced by alternate flaking. The relative flake-component from here includes one small flake with high-angled striking platform and prominent bulb indicating the continuance of the early flake tradition, besides those with low-angled and plain striking platforms. The tools from this site are very fragile owing to weathering so that they are often broken while removing from the deposit. From the corresponding gravel (Gravel I) at Yesar, on the Kan, were recovered a broken but fresh cleaver with a biconvex section, a core, a large flake and a plain-platform small flake, the last three being heavily rolled. The slightly rolled handaxe of oval form prepared on a flat core, bifacially flaked along half the periphery to form almost straight edge and a broad tongue-like tip, obtained from the gravel I in locality VI on the Kan at Bhadne, also belongs to this industrial tradition. Going together with this assemblage are a bifacially flaked chopper on a core of trap with a square butt-end from Amoda and two cleavers picked up at Bhondgaon in the bed of the Utavali *nala*, one of which, a fairly large one, is on an end-flake with a V-shaped butt-end and an angular sharp edge and the other, a U-shaped one, also an end flake, with its margin marked by small stepped flake-scars indicating the use of cylinder-hammer technique. The use of cylinder-hammer technique in this Early Stone Age industrial stage is further attested by a rolled, beautiful handaxe with an extremely trimmed side and a curved tongue-like tip, which was recovered from the junction of the Gravel I with the red concretionary clay at Bhadne.

From the red concretionery clay at Amoda one fresh massive core of trap with medium-size deep flake-scars was recovered.

The upper gravels of Gravel II consist of re-deposited material, in which heavily rolled evolved Acheulian bifaces, including handaxes, cleavers, ovates- one of them being with S-twist- and discoids, besides scrapers and flakes as well as some cuboid and ovaloid specimens, which, from their form and features, appear to have been functioned as hammer stones have been found. From the *in situ* fine gravel portion of this deposit were recovered, at Bhadne and Yesar respectively, a fresh flake of trap and an advanced Acheulian cleaver in 'mint' condition, discarded perhaps owing to breakage while under preparation, with square butt-end, tiny stepped flake-scars along the margins showing the use of cylinder-hammer technique and trapezoidal in cross-section. The collection of lithic artefacts made from the debris of this gravel extracted from a well at Dahivel consists of a discoidal core, a hollow scraper and a dozen flakes, all of trap. From the lenses of ferruginous gravel in the overlying fissured clay a few flakes and an end scraper were recovered. The corresponding gravel on the Amravati-Bhad *nala* at Bhadvad Khurd yielded advanced Acheulian bifaces. Heavily rolled tools of the same complex came from the overlying fissured clay. Gravel II with its fissured clay is thus contemporary with the advanced biface Acheulian industry.

Wherever the fissured clay was met with, it is interesting to note, it showed an unconformity with the overlying gravel (Gravel III) containing tools of the Middle Stone Age. This clay seems to have undergone weathering as, at many a sites, such as Dahivel, Perajpur, Chhadvel, Bhadne and Yesar in the Kan basin and at Bhadvad Khurd on the Amaravati-Bhad *nala*, it shows distinct soil characteristics, thus indicating a time gap between the end of the deposition of the clay and its subsequent capping by the Gravel III. This time gap seems to be synchronous with the open-camp sites at Ranala Khurd, Vadjakhan, Nandarkha, Raygad and many others that have yielded tools of an identical complex. The handaxes, cleavers, ovates, discoids from are small in size showing a highly developed Acheulian trend. Mousterian cores recalling disc-cores constantly recur. The flake-tools, such as scrapers and points, retouched along the margins, seem to be detached from such cores. Long and broad blade-flakes, many with secondary working and corresponding cores are also included in these assemblages. On the whole, progressive diminution in the size of the tools and a developmental trend in the technique of their production are clearly visible in this stage. The use of cylinder-hammer technique is prolific and the "Blade technique" has gained ground. A shift from the use of hard trap and dolerite from dykes to the fine-grained red basalt and silicious tuff in some areas of the region, e.g., in the Ranka basin, in the preparation of tools, is a point worth noting. Essentially, this is a 'flake industry' with a small proportion of bifaces of the highly advanced Acheulian type. These assemblages, therefore, seem to represent the formative stage of the Middle Stone Age industry of Gravel III.

Gravel III yielded blade-flake-scraper-point implements of the Middle Stone Age, made chiefly on jasper and fine-grained red basalt. Techno-typologically these assemblages are akin to those found elsewhere in the Northern Deccan. One fossil bone was recovered from this gravel at Bhadne on the Kan in association with lithic artefacts.

The lithic tools collections from the Gravel IV are typified by ribbon blade-flakes, occasionally retouched, as well as narrow parallel-sided blades and blade-flakes, and corresponding cores; Mousterian type diminutive disc-cores; scrapers; points and burins. The materials used are jasper, chalcedony and agate. The tools are comparatively smaller in size than those of the Middle Stone age but a little larger than those of the Late Stone Age. The tool assemblages, ascribable to the Gravel IV phase, from the open camp sites at Raypur, Bhadgaon, Dhavalivihar Pada and others situated on the Nizampur plateau, include, besides all the above mentioned characteristic tool-types of this Stone Age stage, tanged varieties of scrapers and arrowheads of the transverse type.

The lithic tool industries of the Gravel V, ascribable to the Late Stone Age, are microlithic in character and made chiefly on chalcedony with jasper and agate being also used occasionally. The tool-types included in these industries from open camp sites and the gravels as well as silts from river sections are irregular cores, cuboid, cylindrical and conical fluted cores, blades with and without retouch, backed blades, triangles, lunates, points, awls or borers, burins and occasionally small scrapers. None of the sites of this period yielded any pottery. At Chaupala on the Sukar *nala*, from an ashy grey calcareous silt, varying in thickness from 60 cm to 2 m, and unconformably overlying the reddish brown current-bedded sand and fine gravel, and underlying a deposit of brown fine gravel, a few microliths, seemingly of this complex, were collected in association with one animal scapula, molluscan shells and charcoal bits. From a well section at Jaitana, Late Stone Age tools were collected in association with a fossil bone. Deserving special mention is an evidence of the occurrence of a crude wavy ridge on some cores and flakes ascribable to this period, which has been prepared in the same way as that commonly met with on the specimens of the highly evolved Chalcolithic blade industry. The specimens so far found by the author with such a wavy ridge in Dhule District include a fluted core and a core-flake from an open air site at Kumbhar Pada; a prepared cuboid core-nodule of jasper with double striking platform recovered from in situ gravel on the river Buray at Mahunji Pada; and a blade-flake recovered from the yellow sandy silt on the Kan at Amoda.

By the Late Stone Age times, the flood plain was raised to a considerable height and an alluvial plain was formed in the river valleys of the region. As a result, the Late Stone Age man seems to have felt more secure and convenient on hill-slopes as is judged from the location of many open camp site or 'factory site' of this complex on the top of river side hills.

Gravel VI, overlying the grey or brownish grey silt of the Gravel V, as already said, has been discovered very recently in the upper Buray basin. So far no contemporary cultural remains have been found in this gravel. In this part of the region the gravel is capped by dark brown or black soil.

The Chalcolithic Evidence

Habitation Sites

The sites were situated mostly on or not very far from the river or *nala* banks. High ground was chosen for habitation, apparently to avoid danger from floodwaters. In the Tapi basin the sites were found to have been situated at a height of over 9 m from the present river bed. Even the modern villages have cared to choose the highest portion for habitation. Wherever sections were available for reasonable study, the Chalcolithic ashy grey occupational deposit rests on black soil while at the sites at Borda, Pimpalner and Kandhra, it rests upon an immature soil. Nearer to the banks of the Tapi at Savalda and Prakashe, the Savalda Ware was found lying upon the eroded surface of the yellowish alluvial deposit whereas on a part of the site at Kaothe this was found on the top of a calcareous gravel deposit on the left bank of the river Kan. As a result of heavy erosion most of the sites, which originally might have had a thick occupational deposit and might have been fairly extensive, have been reduced to almost the level of the surrounding ground. In many cases, the cultural deposit was seen surviving in sporadic small patches only while in some others only stray potsherds and microliths were seen left behind. Barring the sites at Savalda (Site-3), Khaparkheda (Site-1), Saidnagar, Baldana and Hatnur (the extant mound), all those found in the explored region are under cultivation.

Burial Sites

Burial sites, located a little away from the habitation area, were discovered at Bhondgaon, Korat, Shahada, Mandal and Chikse while burials were also noticed right in the occupational deposit of many habitation sites. At Hingni, burials were noticed in the peripheral area of the site. At some villages, only burial sites were found, the evidence of habitation being completely missing owing probably to heavy erosion. The Chalcolithic burials so far found in the district, are like those at Tekwada (IAR 1956-57: 18-19), opposite Bahal on the Girna, a tributary of the Tapi and have no surface indications. For reasons beyond control of this author, it was not possible for him to expose fully any of the burials with a view to knowing details. Surface observations, however, indicated that the mode of burying and the burial furniture did not differ from that noted at Tekwada.

The ceramics found in the naturally exposed burials are the Jorwe Black-on-Red ware, Black-and-Red ware, Red-slipped ware, Black-and-Grey ware and thick coarse ware. In type, fabric and decoration, the Jorwe black-on-red ware from burials is akin to that from habitation sites, the only distinct feature of that from the former is that it bears graffiti marks as on the other associated wares described below. The Black-on-Red ware is of fine fabric, treated both internally and externally with a slip and is burnished. It is fired under reducing and oxidizing conditions of the kiln and as result the entire interior and the upper part of the exterior, near the rim, have turned black and the rest of the exterior pink, grey, buff and their shades. The types commonly met with in the black-and-red ware are bowl with a clubbed or beaded rim and carinated shoulder and bowl with concave neck, sharpened rim and carinated shoulder. Corrugations below the shoulder were also noticed on some examples. From the burial site at Maindana a thick variety of this ware, similar to that found on the habitation sites at Bhondgaon, Kaothe and Ghodada, was collected. Examples of all black ware were also found in some of the burials in the region. The red-slipped ware is wheel-made and is apparent from the clear striation marks on its interior. It is prepared of gritty clay and treated with a slip on the interior portion of the rim and on the exterior up to the shoulder. Handi-type vases are common in this ware. The thick coarse ware, as its name implies, is thick and of course of gritty fabric. It was used probably as a burial urn. Occasionally these urns seem to have had handles, as can be surmised from the specimen of a loose handle collected from Lonkheda. The type represented in the black-and-grey ware from the burials at Korat is a bowl with a concave neck and carinated shoulder. A stem of dish-on-stand found in a burial at Vaka in this ware is also noteworthy. The other characteristic features of this ware are similar to those of that found on the habitation sites. Except the thick coarse ware, all the above mentioned wares associated with burials bear post-firing graffiti marks which include ladder pattern, V-shaped marks, swastika, stepped lines, intersecting lines, opposed triangles, etc.

It is noteworthy that from the burials at Dahidula Khurd and Dhule (Site-2), respectively animal teeth and a fragment of a horned animal were recovered. Of these, the burial at the latter belongs to the Late Harappan complex.

Factory Sites

In the proper Tapi basin factory sites were found, in general, close by the habitation sites. The reason apparently seems to be that water-worn pebbles of the required raw material were plentifully available in the shingle bed of the Tapi. This is borne out by the occurrence, on these sites, of split-pebbles of chalcedony, jasper and agate, which are the raw materials used in the preparation of tools by the Chalcolithic folk. In the areas away from the Tapi basin, however, the factory sites were noticed a little away from the habitation sites in close juxtaposition of out-crops of basalt, which are traversed by the veins of the above said raw material.

Structural Remains

No structural remains assignable to the Chalcolithic were observed during the surface exploration on any of the sites so far discovered, save for the evidence of a thick ash deposit at Kandhra and Balsana, at the former lying along the eastern and north-eastern periphery of the site, and that of a couple of burnt clay-lined enclosures containing ashy material noticed at Kaothe.

The Cultural Equipment

During the surface exploration black-on-red Savalda, Late Harappan and Jorwe wares were found on a large number of sites and in large proportion whereas Lustrous Red ware and Black-painted Red-Buff ware and the White-Painted Black-and Grey ware were obtained from a limited number of sites and in much smaller proportions. The associated wares from the habitation sites are Grey ware, Thick Coarse ware and Black-and-Red ware. The other finds included in the material equipment of the Chalcolithic people of the District are microliths, including fluted cores, parallel-sided blades with and without retouch, backed blades, lunates and points; flakes of trap and fine-grained red-basalt, occasionally secondarily worked, and amorphous and discoidal cores; stone objects, including querns, mullers, fabricators, mace-heads and balls; spindle whorls and some indetermediate objects made of pottery; a faience bead from the Late Harappan site at Dhule and a disc bead of ivory of shell from Tilali; shells with and without perforations; conch shell pieces; antlers and a couple of terracotta objects, including net-sinkers (Sali 1964: 34-35) and a fragment of marble.

The site of Bahyana (Site-2) and Dhule (Site-2) have yielded remains exclusively of the Late Harappan phase. Since the evidence is interesting in that it gives an idea of the cultural equipment of the Late Harappan of the District, it is detailed here. The former, completely disturbed owing to seasonal ploughing, yielded, besides the typical Late Harappan ware, the Grey ware and the Thick Coarse ware. The fluted cores and the core-nodules from the factory site situated close by are much larger than those ordinarily found on the Chalcolithic sites of the region. On the latter only a few patches of occupational deposit were seen surviving. Besides, a seemingly eroded burial was also found here. From one of the patches of occupational deposits were recovered potsherds of the Late Harappan Red ware, Grey ware and Thick Coarse ware; microliths including two long blades, one each of chert and jasper; shells, two of them bearing perforation; a long, cylindrical, circular bead of faience; a roughly U-shaped pottery object of indetermediate use; a fragment of a muller of trap, and a large number of animal bones. From the eroded burial were obtained almost half-portion of a thick vase of Late Harappan ware with a beaded rim, belly-shaped body and disc-base and a pottery object of indetermediate use, a microlith and a fragment of skull of some horned animal. The Grey ware has a gritty and porous core because of admixture of gritty material in the clay in a considerable proportion. Thick in section and treated mostly on the out side with a thick-slip and burnished, its surface colours include grey, pink and their shades. The types represented in this ware are vase with flat, dished and disc-base; vase with out-turned rim; vase with bluntly carinated body and basin or trough. The rim-top of one of the fragments of this ware is painted in ochre colour with a horizontal band. This ware was perhaps meant for rough use such as cooking, storing water and the like. The Thick Coarse ware of the Late Harappan period was chiefly meant for storage purposes, as is apparent form the thickness and the large shapes of the vases.

It is devoid of slip and its surface is rough. The types represented in this ware are vase with an everted rim and vase with almost vertical profile. The ware is decorated with incised and applied decorations, especially on the rim and shoulder, which include chevrons, oblique lines and dots. One of the sherds, which appear to be a base-fragment, is mat-impressed. Thus, the cultural equipment of the Late Harappan of the region comprises pottery including the thick and sturdy Black-On-Red ware, Grey ware, Thick Coarse ware, microliths, including large fluted cores and core-nodules from Bahyana and long blades from Dhule, reminiscent of their tradition of ribbon blades, a faience bead, pottery objects of indetermediate use, shells with and without perforation and a muller of trap.

The salient features of the ceramics found on the habitation sites are detailed below:

Savalda Ware

The Savalda ware, as the author proposes to call this newly discovered black-on-red ceramic, represents a distinct Chalcolithic culture, named after the type site of Savalda, where its distinguishing features were confirmed, was found at a number of sites in the District (Sali 1963: 207-210). The ware is wheel-made, seemingly on a slow wheel, but appears to have been carelessly potted as is shown by the overlapping and irregular striations. Except for the occasional sprinkling of the examples of fine fabric, the ware on the whole is prepared of gritty clay. Normally it is well fired but specimens of both over and under firing are not wanting. Although on the whole the ware is thinner than the Late Harappan but slightly thicker than the Jorwe ware, its thickness is not uniform, that is maximum thickness occurs at or near the junction of the shoulder with the body and maximum at the base. With pleasing surface colours, including red, orange, pink, buff and their shades, the ware is elaborately treated with a slip. The types met with in this ware are vase with high neck and slightly out-curved rim; vase with a high neck, out-turned rim, blunt carination and squat body; vase with slightly flared rim; vase with almost vertical rim; dish; dish-on-stand; bowl-on-stand; trough or basin; bowl; lid with and without a knob and ring-stand with incurved profile. Artistic or realistic decorations is one of the important features of this painted ware. The paintings have been executed mainly in black, occasional examples in ochre red, reddish brown, chocolate and purple colours being also present. Some designs in relief suggest the use of thick pigment. From the way designs have been executed by free hand, a fine flexible brush seems to have been used by the potter-painter. The designs can be grouped under the following four broad categories.

1. Animal and bird motifs
2. Arms or weapon and tool motifs

   This is probably the only painted ware so far found in the Indo-Pakistan sub-continent on which are illustrated so profusely various contemporary arms or weapons and tools. These are arrow, antennae-ended spear, harpoon or multiple-barbed spear, arrowhead with V-shaped or U-shaped notch, unilaterally barbed tool closely resembling a saw and single and double barbed fishhooks.
3. Stylised plant or plant-like motifs

   Plant-like representations are seen on only a few of the sherds so far collected.
4. Geometrical and other motifs

   These include trellis pattern, horizontal bands, long thin lines, loops, spirals, lines partly straight and partly crinkled, chain pattern, wavy lines, groups of leaf-shaped strokes, comb-like designs, groups of short strokes, etc.
5. Animal and Bird Motifs

   The animal and bird motifs have been executed in a naturalistic form and in the silhouette method. These motifs include peacock, fish and some intermediate ones including aquatic-like creatures as also horned and other animals and birds. An example of a frieze of birds is also noteworthy.

Pre-firing as well as post-firing graffiti marks are seen on some of the rim and neck fragments of this ware. Except one, which looks like the English letter Y, with two lines standing on one of its arms, one vertical and the other parallel to the former, the marks on all the available specimens consist of vertical lines.

Late Harappan Ware

The Late Harappan Ware, so termed because of its close resemblance, chiefly in fabric and types, with the red ware of Bhagatrav I B (IAR 1957-58: 15) and Mehegam (IAR 1957-58: 15), respectively on the Kim and Narmada estuaries, ascribed to the Late Harappan period contemporary with Rangpur II B (Rao 1963), is prepared of well-levigated clay with fine sand as the tempering material, thick, sturdy, well-fired and produces an excellent metallic ring. Turned on a fast wheel and treated with a thin slip which has turned red, orange, chocolate, purple and their shades, the ware is decorated on the outside, and at times on the inside of dish-on-stand, in black, and occasionally, e.g. at Nyahali, Hingni and Ghodada (Site-3), in violet, with horizontal bands on the rim, neck and shoulder, wavy vertical lines, trellis pattern, loops below rim-band and simple plant-like motif. The chief types in this ware are vase with a beaded rim, belly-shaped body and disc-base; vase with a heavily beaded rim; vase with a flat base; vase with dished or concave base; vase with oval-collared rim; jar with a horizontal or flat projecting rim and almost vertical or slightly convex profile; vase with flat base and tapering sides; vase with flaring rim; dish-on-stand and incurved bowl. So far only one sherd of this ware has been found to bear graffiti which consists of a rough outline of a stem of dish-on-stand (?) and a few irregular lines.

Jorwe Ware

The Jorwe ware has been found on habitation as well as burial sites. It is a matt dull-red ware prepared of well-levigated clay with sand as the tempering material and treated with a wash. It is turned on a fast wheel and well-fired. The chief types in this ware are carinated bowl, vase with cylindrical neck, beaded rim and globular body and vase with short narrow neck and pear-shaped body. The ware is painted in black with monotonous geometric designs such as hatched triangles, diamonds and circles, oblique lines between horizontal bands, and horizontal bands, the only exception being that from Nashinda on the Tapi, which is painted in violet and ochre red.

Black-and-Grey Ware

The black-and-grey ware was found chiefly on the Tapi basin sites. It is of medium fabric, treated both internally and externally with a slip and burnished, the slip on the exterior of being thicker consistency. The paintings in white, invariably on the inside, include rows of dots and short strokes. The lota-shaped vase and bowl with concave neck and carinated at the shoulder are the types that are met with in this ware.

Lustrous Red Ware

Lustrous Red ware was found at Hagri Pada, Nyahali, Vaindana and Kaothe. It is of fine fabric and treated with a deep red slip.

Red-Buff Ware

This ware is of medium fabric and treated with a thin slip which has turned red and buff and their shades. Normally it is as thick as the Jorwe ware but is comparably lighter in weight. The painted designs in black on this ware consist of animal and plant motifs and geometrical designs, including crosshatched triangles and diamonds, horizontal bands and wavy lines. The characteristic feature of animal and plant motifs is that the empty space created by drawing the figure or design in outline is filled with short strokes or dots or by hatching. It should be mentioned that this ware is similar to the black-painted red ware of Malwa fabric of Sub-period I A at Prakashe.

Black-and-Red Ware

The ware was found in two varieties, thick and thin. The latter, typical of the Chalcolithic burial sites of the region, was found in the occupational deposit of the Chalcolithic only at Borda. Its occurrence in the occupational deposit here can not be precisely explained at this stage although it seems quite plausible that it should occur in the habitation area where the pottery was perhaps made. The former variety was found at Nevala on the Tapi and Bhondgaon, Ghodada and Kaothe all in the Kan basin. It is of medium fabric and has been fired alike the thin variety so that the interior and the upper part of the exterior have turned black and the remaining of the exterior red. The sherd representing type from Bhondgaon is of a large bowl with a carinated shoulder and a beaded rim.

Grey Ware

The Grey ware was found on all the habitation sites so far discovered in the region. Of coarse fabric, it is treated with a slip and burnished. Chief among the types in this ware are vase with flaring rim and bulbous body; vase with tapering rim; vase with almost vertical rim; vase with a beaded rim; large bowl with incurved profile; dish or platter and lid. It is occasionally decorated with incised decorations, which include wavy lines and rope pattern. Occasionally it is painted in ochre colour with a rim-band.

Thick Coarse Ware

Of coarse gritty fabric and thick in section, this ware is hand-made and devoid of slip. The representative types in this ware are platter, vase with flaring rim and vase with everted rim. It is decorated with incised and applied decorations which include chevrons, wavy lines, dots, plant-like pattern, finger-tip decorations on an applied band, snake-like pattern in applique, etc.

Conclusion

The foregoing review of intensive exploration in Dhule District would show that the region has produced much that is new and of interest.

There are six gravel sequences of the Stone Age in the so far explored area of the Tapi valley. It is for the first time that such a comprehensive cyclic picture of the Stone Age has emerged in the Deccan Trap region.

Interesting is the evidence of two fossil soil beds, one of them formed during the period of transition from the Early Stone Age to the Middle Stone Age and the other during the period of transition from the Late Middle Stone Age to the Late Stone Age, the latter observed so far only in the upper Buray basin.

From the cultural point of view, we have evolutionary evidence, both stratigraphic and surface from the Early Stone Age to the Late Stone Age through the Middle and Late Middle Stone Ages.

The Early Stone Age is divisible into three to four evolutionary stages: the first, perhaps of the pre-Gravel I stage, marked by the early Clacton-type very large and thick flakes, some with primitive cleaver form, accompanied by perhaps also the core-tool industry of the early Abbevillian type; the second of the Mid-Acheulian bifacial industry of the Gravel I; the third, of the Gravel II, marked by the advanced Acheulian bifacial industry; the fourth is characterized by the highly evolved Acheulian bifaces accompanied by Mousterian-type cores, finely retouched scrapers, points, awls and long and broad blades and corresponding cores indicating the use of "Blade Technique" and thus showing unmistakable progressive trends. It should be mentioned here that the raw material used in the artefacts of the fourth stage is of a different variety of trap and looking to the rarity of tools of hand axe category this stage may be representing the earliest Middle Stone Age stage.

Developed from the fourth evolutionary stage of the Early Stone Age there are the Middle Stone Age blade-flake-scraper-point assemblages of the Gravel III. An advanced stage of this is represented by the ribbon blade-flakes as well as almost microlith-size blades including the backed varieties and corresponding cores, diminutive disc-cores, scrapers, points, arrowheads and burins, ascribable to the Late Middle Stone Age, its stratigraphic horizon being the Gravel IV.

The Late Middle Stone Age industries were transformed into the microlithic of the Late Stone Age which are found in the Gravel V. An interesting aspect of the Late Stone Age industries of the region is that in these we occasionally find specimens with a crude wavy ridge resembling a crested ridge and prepared by the same technique as that used in the highly evolved Chalcolithic blade industries.

The Gravel VI overlying the grey or brownish grey silt and underlying the dark brown or black soil found in the upper Buray basin has not so far yielded any cultural remains. It is, however reasonable to hope that they may be forthcoming in the course of further explorations and thus may bridge the gap between the Late Stone Age and the Chalcolithic period.

But for a few exceptions as at Borda, Pimpalner and Kandhra, the Chalcolithic occupational deposit in the region was found resting upon the black-soil as elsewhere in the Northern Deccan. The presence of such a large number of sites in the explored area suggests that the region was fairly thickly populated during the Chalcolithic times. In the so far examined stretch of the Tapi proper the average distance between the two Chalcolithic settlements comes to about 2 km.

Surface explorations have revealed three main cultures of the Chalcolithic, viz Savalda, Late Harappan and Jorwe, each one characterized by a distinct class of Black-on-Red ware of its own. The presence in small proportions on some of the sites of the White-Painted Black-and-Grey ware, typical of the Banas culture of Rajasthan and the Lustrous Red ware, which represented the post-Harappan Chalcolithic phase at Rangpur in Gujrat, indicates contact of the Tapi valley Chalcolithic peoples with their contemporaries there. Mention should also be made of the Black-Painted Red Buff-ware, similar to the Black-Painted Red ware of Malwa fabric of Sub-period I A at Prakash, which has been found on some of the sites. The other wares, which occur on the habitation sites, are the Grey ware, the Thick Coarse ware and the Black-and-Red ware.

Of the three main Chalcolithic cultures, the Savalda culture is one of the new outcomes of the author's exploration in the District. Although the author could not tap any of the Chalcolithic sites discovered with a view to knowing the stratigraphic position of the Savalda culture in relation to the other Chalcolithic cultures of the region, surface observations at Balsana and Kandhra suggests that this culture precedes the Late Harappan. Subject, however, to confirmation by further evidence through excavation, this would mean that the Savalda culture was already present before the arrival of the Late Harappans on the scene.

The pleasing surface colours of the Savalda ware and the exquisitely executed linear and other designs as also the use of other colours, besides black, attests to the high artistic level of the authors of this ware. A general idea of some of the cultural aspects of the Savalda people can be had from the study of painted motifs on their pottery. Their fighting and hunting equipment included bows and arrows, harpoons or multiple-barbed spears. The representation of a saw suggests that these people knew this device of carpentry. An illustration of two lines partly straight and partly crinkled shows resemblance with drill-like objects. The leaf-shaped strokes may perhaps be a representation of needles. No specimen of the aforementioned tools and weapons, which could be associated with this Black-on-Red ware, has so far been found in the region and as such it is not possible to say as to what material they used for preparing them. That fishing was in vogue amongst these people is very well attested by the fish-motifs and the single-and double-barbed fishhooks painted on the pottery. For hairdressing they had known the use of comb. Peacock seems to be a favourite bird to them.

Excavation of some of the sites in the region is necessary for probing into further details of this culture. It should be mentioned herein that such a necessity has now been all the more accentuated because of the recent reported occurrence of the Savalda ware in the region as far as south as the Districts of Bijapur and Belgaum in the Krishna valley (Sundara personal communication) (about 700 km south of Dhule as the crow flies), suggesting a vast expanse of this culture.

The sway of the Late Harappan in Dhule District is indicated by the discovery of the Late Harappan ware on several sites. The so far found cultural equipment of these Harappans is in itself indicative of their existence in the region in a degenerate form. The site at Dhule is the so far known southernmost Late Harappan site in the region. It is also a hitherto known southernmost extension of the Harappan culture, in its degenerate form, in India.

The Jorwe people seem to have penetrated into a much more interior part of the region than did the other Chalcolithic cultures of the District.

The Chalcolithic burials in this region, alike those at Tekwada on the Girna (District Jalgaon), have no surface indications.

Thus, the exploration in Dhule District has furnished both stratigraphic and cultural evidence of the Stone Age as well as material evidence throwing light on the march of man, stage by stage, from savagery of primitive flake-tool tradition of the Early Stone Age to civilization of Chalcolithic period with a cultural gap between the Late Stone Age and the Chalcolithic, representing perhaps a traditional stage from the hunting and food-gathering life to that of a food-producing one, which, as the author hopes, in the course of further explorations, may be filled up.

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Interpretation of the Fecundity Seal from Harappa as a Pictorial Representation of RV V: 78 with the *asvin* Twins as Presiding Deities

P.V. Pathak

10, Sangam Apartments,
Anand Nagar, Sinhagad Road,
Pune 411041

Abstract

The fecundity seal from Harappa Fig. (1 A, B) is so named, because it carries a picture of a lady with a tree coming out of her womb. On side A of the seal, a standing human figure is shown holding a dagger or a weapon in one hand and a shield in the other. This standing human figure appears to be protecting the other human figure who is in a sitting position, holding both hands on his head as if defending himself. On side B, two animal figures in standing position are shown on the left hand side while on the right hand side is the fecundity symbol with a tree shooting out from the vulva of a lady in inverted position.

The Vedic twin deities, the *asvins* are associated with fecundity and childbirth in the RV hymn V.78. whose presiding are the *asvin* twins. The hymn is also known as *garbhhasravinyupaniṣad*. The seer of the hymn *saptavadhriratreya* urges the deity *asvins* to protect him in V.78.5. This is shown pictorially on side A where the standing human figure represents one of the *asvins* and sitting human figure the seer himself. The seer urges the twin deities to come to him running like two wild cattle, the Gauras i.e. *Boves Gauri*. These are depicted as two animals figures standing on their hind legs and facing each other on side B. The simile of a lady with widened legs while giving birth to a child in RV V.78.5 and a tree coming out of her womb is shown on the right hand side of the seal. The *Ṛc*s 5-9 of the hymn are benedictions for the proper growth of a foetus, safe pregnancy and childbirth. On account of these *Ṛcs,* the hymn was titled *garbhhasravinyupaniṣad*. Thus the seal is a pictorial representation of the main theme of RV V.78.

The Seal Description

The author has earlier shown that many Indus culture seals are pictorial representations of *atharvavedic* hymns (Pathak 1991, 1992, 1997, 1999). These seals can be interpreted almost *Ṛc* by *Ṛc* of the reference *sukta* from the *atharvaveda*. In this article the author has dealt with a seal from the Indus culture (Fig. 1 A, B) from Harappa (Vats 1940: 304) which he proposes is the pictorial representa-

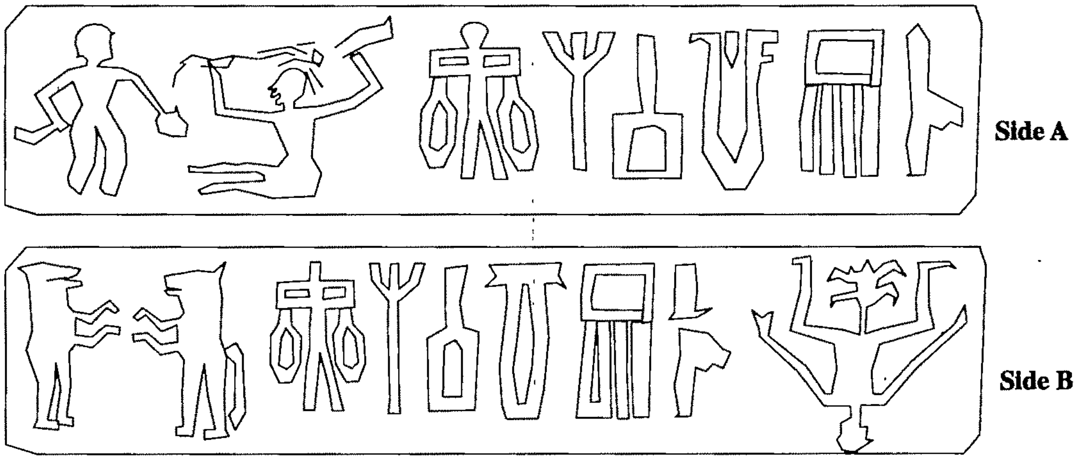


Fig. 1: Indus culture seal obtained from Harappa

tion of R̲gvedic hymn V.78. The seal is rectangular in shape and inscribed on both sides. It carries six identical Indus culture symbols on either side.

On **side A,** two human figures are shown on the left side. The figure on the extreme left is holding a dagger or a sharp weapon in left hand and a thing like a circular shield in the right hand. Its face is turned towards the next figure. The next figure is that of a seated person with legs spread forward and both the hands raised upwards. While the first figure is in a combative posture the second figure is in the protective or submissive posture. It is followed by symbols from the Indus script.

On **side B,** there are two animal figures on the left side followed by the same six symbols as on the obverse side. The animals are standing on their hind legs and are facing each other. The author has identified them as Gauras, i.e. Boves gauri. Then comes the human figure in the inverted position. Its hands and legs are spread side ways and a plant or tree with branches is shown emerging from its vulva. Since it shows a plant coming out of the vulva of a lady and it matches with the theme of the R̲gvedic hymn RV V.78, the seal is named here as a fecundity seal.

Earlier Interpretations

This seal has not attracted attention of many scholars. The author here proposes to deal with three interpretations and his to comment on those interpretations.

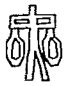
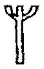
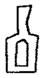
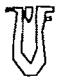
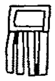
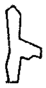
Buddhaprakash's View

Buddhaprakash (1966) has interpreted the seal as a depiction of a scene of human sacrifice to the mother goddess. According to him, the standing figure is holding a sickle like knife in one hand and perhaps a bow in other hand. The seated human figure is that of a lady. The standing figure intends to immolate the lady on the other side of the seal. He has then referred to,

> "a picture of the primitive agricultural ritual consisting of the ceremonial killing of a member of the community and distribution of his or her flesh among the people, and scattering of the portion of it in the fields with a view to increasing of fertility of the soil. In New Guinea, Melanesia and Polynesia the sacrificial being is a male, but in Indonesia it is female. Some times a couple was sacrificed. After the sacrifice a new couple was made to descend from the top of a tree and indulge in sexual intercourse, which was mostly promiscuous and even incestuous. All these concepts and practices crystallized in the doctrine of prajapati and his yajna." (Buddhaprakash 1966:43).

One of the most important lacunas in this interpretation is that no cognisance of the animal figures facing each other on side B of the seal has been made. Secondly, the statement that the standing human figure on side A is holding a dagger and a bow in either of the hands is inconsistent. One can understand the bent weapon being a dagger, but the circular shaped object does not match with it being a bow. The ritual of immolating a female sitting in front is also a speculation. Nowhere in India was the sacrificial victim immolated and Buddhaprakash himself writes about distribution of the flesh of a victim and scattering of flesh in the field. Since he has not given any reference to the practice of immolation either from outside India or from the Indian tribes, the authenticity of the information is doubtful. He refers to the practice of sacrifice from

Table 1: Meanings for the Indus Graffiti symbols given by Fairservis (1992)

Symbol	Identification	Homophone	Meaning
	– a man with a carrying pole with looped cords	*al kavadI*	watchman
	– stalk of grain (abbreviated form)	*nIla*	lunar month
	– enclosure with pillar or pole	**tol-*toN*	number 9 cow(s)
	– pot with handles and a genitive affix	-	upper, up river north
	– No identification given	-	-
	– stairway or shairs	*meTTu*	heap, accumulation of commodity

Southeast Asian countries and draws the conclusion that they were "crystallised in the doctrine of *Prajapati* and his *yajna*." It becomes imperative that he should refer to either YV text or some *brahmana* text to substantiate his claims. Buddhaprakash's view therefore appears far-fetched.

Fairservis's Views

Fairservis (1992) has extensively dealt with the Indus symbols and given interpretations of many Indus seals. According to him the Indus symbols convey concepts and words of the Dravidian language (Table 1).

Having identified above symbols with corresponding homoforms, Fairservis has given interpretation of the seal as in Table 2 (Fairservis 1992: 200-201).

At other place, Fairservis (1992: 213) has selected the twin tiger symbol along with first two signs calling them as upright (hapless?) tigers paired and equated them with the "Gilgamesh" motif carrying the same relationship to a superman. It is to be noted that Fairservis treats the offshoot from the woman's vulva to be a gavial i.e. a large crocodile, *Gavialis gangeticus* found in the Indian subcontinent and one of the weapons i.e. in the right hand to be a sphere.

Fairservis had started with the premise of the Dravidian roots of the Indus culture. In context of the Indus seals, he has tried to correlate the old Tamil words with the Indus symbols. In case of the current Indus seal, the application of the symbols and their meanings in old Tamil and his correlations become almost incoherent.

a) The human figure does not hold sphere. A sphere is always straight while on the seal it is unmistakably bent like a dagger or an Indian type sword;

b) Person in the sitting posture need not be woman. It could man as will be shown later;

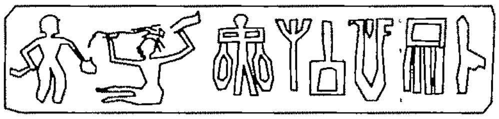
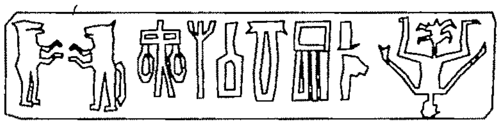
c) The purpose of the meeting a great man with a woman does not become clear;

d) Isolating the two tiger (?) figures and two symbols and equating them with the "Gilgamesh" myth does not explain the purpose of the seal. The Gilgamesh seals in the Indus culture as well as in the Middle-Eastern countries (Teissier 1984) always depict two lions or tigers attacking a hero in the centre. They do not fight with each other.

e) The symbols too do not give any message and somehow the last-but-one symbol is not at all dealt by Fairservis anywhere in this context.

There is no coherence in this interpretation. Fairservis also does not give any mythical or folklore reference, etc. to substantiate his claims. In absence of any Old Tamil reference myth or practice related to great man or an elderly person meeting a lady, it is difficult to accept his interpretation.

Table 2: Interpretation of the seal given by Farisenis (1992)

Side A "Man with weapons: a sphere in left hand knife held at hip in the right hand. Before him a seated women, her arms widespread, palms up; her hair streams off, her legs are out stretched". 	It is assumed to represent the meeting of the great man with a woman.
Side B "Woman birthing a gavial. She is in reverse of the text and is therefore upside down her arms are extended over her knees." 	The gavial is symbolic of First primary chief

Views of Richter-Ushanas

Richter-Ushanas (1992) has dealt with several seals and symbols. He treats the Indus seals to be representing the Rgvedic legends and myths and even the hymns. He has given his interpretations of both the sides of the seal as follows:

Side A

> "The sitting figure with upraised hands on the upper side of the tablet may either be the earth asking for rain or a convict asking for mercy. The man standing in front of him would then be *parjanya*. He holds a ring or a disc in his right hand in its left hand a whip or a sickle. The ring is similar to the ring-stones found in Mohenjodaro. They may have been used in processions as wheels of an amphipic car (cf. RV X.135). Rings are also an emblem of Shiva and the Munis described in RV X.136. This is corroborated by a bracelet lately found in Mohenjodaro."

Richter-Ushanas interprets the meaning of graffiti as: "The man with the thunderbolt, the bull, waters , the plants".

Side B

> "On the left of the lower side of the tablet two men clad in the skin of a leopard or tiger embrace each other.... we may infer that they perform a rain-dance. .... At the right of this side the goddess Earth is shown as giving birth to a tree or crocodile. This is described in RV V.84.2:"You, the separated One, for whom the songs resound in the morning, you bring forth the seed you have received like a neighing horse, o silvery one." (Richter-Ushanas 1992: 40)

Richter-Ushanas (1992) has attempted to correlate the seal pictures with the phenomenon of rainmaking. However he does not offer any cogent correlation with the symbols or pictures with the RV *Ṟc*s and hymns he quotes. He is not sure whether the sitting person is the earth or a convict. If it is a convict, the whole purpose of the seal interpretation is lost. Is it is the earth, then why should the *parjanya* be holding a whip? The ring he has mentioned would serve no purpose here, neither *parjanya* is mentioned to be wearing the ring. So his description is incoherent with the scene. On the side B the standing figures are stated to be animal skins. In the RV text, many gods are called as bulls gaurs etc. directly. In that case, why should there be need to use mask or animal skin. The figures represent the gods themselves as shown below. While Richter-Ushanas is not sure whether it is a plant shooting out of the vulva of the inverted figure, or is a crocodile, in the hymn RV V.84 dedicated to earth, the *Ṟc* V.84.3 refers to the plants flourishing on the earth. The two hymns he has referred, namely RV X.135 & 136 have different purposes. RV X.135 is typically description of the funeral ceremony of a young person, *kumara* and X.135 describes the higher state of fellowship of the deities of the air and the semi-gods attained by a Muni while performing penance. The use of the girdle ring becomes irrelevant in context of the seal pictures.

Theme of RV V.78 and the Fecundity seal

The presiding deities of the hymn RV V.78 are the *asvin* twins. The seer of the hymn is *saptavadhriratreya*. There are 9 *Ṟc*s. The theme of the hymn engraved on the seal is as follows:

a) The seer invites the twin deity *asvins* to come like two swans: *hamsaviva a patatam* (RV V.78.1-3) or like deer: *hiriniviva* (RV V.78.2) or a pair of Gauras, i.e. *Boves gauri*: *gauraviva* (RV V.78.2). It is to be noted that Gauras do not possess horns as prominent as an ox. The twin (standing animal) figures on the side B therefore represent *asvin* twins invited by the seer in V.78.1.

b) A tree is stated to come forth a sundering in two parts like a vulva giving birth to a child i.e. *sus̱yantya yonih iva* (V.78.5). Here in the *Ṟc*, a tree bifurcating a vulva is clearly stated. It is shown on the side B by a tree coming out of the vulva of a lady lying upside down.

c) When the seer *saptavadhr*i was wailing and crying for help, *asvins* came to his rescue and by their magic powers cut the tree into pieces – vrksm sam ca vccacathah (RV V. 78.6). One of the *asvins* is shown on the left end of side A. He holding a pointed weapon or a sickle for cutting a tree referred in the *Ṟc*. A person sitting in front of him is the seer who is crying with both of his hand pointing upwards. The tree branches cut by the deity are shown above his head. So the seer is either praising the deity in front or trying to save himself from the tree branches falling on his head.

d) The *Ṟc*s 7-9 expresses the benedictions for the proper growth of a foetus and to be born unharmed. The great commentator of the Ṟgveda, *sayanacarya,* has called the last three *Ṟc*s of the hymn i.e. 7-9 as the *garbhhasravinyupanis̱ad* – the liturgy of childbirth.

Griffth while commenting on the hymn stated that

> "By *yos̱a nadhamana* (a wailing woman) (RV V.78.4) a parturient woman may perhaps Ludwig thinks, be intended. Atri as he descended into a pit, invoked the *asvins* that they might release him as a woman releases a child she bears. A tree – which is much harder and firmer than a woman's body – unclosed itself when Saptavadhri invoked the *asvins*. So shall the parturient woman bring forth her child through the help of the *asvins* and at Atri's intercession."

These comments of Griffith on the relevance of the hymn are very pertinent here. "They established the use of the seal as magic amulet to be used either at the time of a childbirth or by a pregnant lady in the tenth month of her pregnancy. The tenth month of pregnancy is repeatedly mentioned in the last three Ṟcs of the hymn."

Conclusions

1) The fecundity seal is so labelled, as it shows a tree coming out of a woman's vulva.

2) Theme of the RV hymn V.78 is represented on the seal as

a) the *asvins* twins are called as gaurs and are represented by twin animals standing on their hind legs;

b) theme of a tree asundering the vulva is shown on the seal;

c) one of the *asvins* is shown to be holding a dagger or sickle like weapon and has cut a tree in pieces when seer *saptavadhri* invoked him.

d) The seer *Saptavadhri* is shown in sitting with hands held upwards as if either crying or praising the deity in front or trying to save himself from the falling branches.

3) The seal was possibly used as magical amulet by a pregnant woman or during childbirth for the safe birth of child.

Acknowledgements

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Redefining the Rigvedic and Harappan Connections

Shivaji Singh

Shivala Nagar
Mohaddipur
Gorakhpur 273 008

Abstract

This article discusses various issues related to the Vedic Culture and Harappan Civilization using evidence relevant to South Asian Protohistory in general and the Aryan invasion/migration theory in particular that formed the very basis of Vedic-Harappan dichotomy. Archaeological and genetic findings rule out the possibility of a second millennium B.C. arrival of Aryans in India.

Introduction

In earlier models, based on the Aryan invasion/migration theory, the Vedic Culture was taken to be chronologically later than and qualitatively inferior to the Harappan Civilization. The Vedic Culture was not accorded even the status of a 'civilization' since by definition the culture of an urbanized and literate society alone could be so designated and the Vedic people were presumed to be illiterate agro-pastoralists ignorant of city life. So powerful was the hold of the earlier paradigm that a prestigious UNESCO publication, *History of Mankind*, labelled the Aryans as a 'non-urbanized people and semi-barbarous' (Hawkes and Wooley 1963: 406) who destroyed the non-Aryan Harappan Civilization.

Today, the Vedic-Harappan dichotomy is under grave doubt and scholars are now impressed by the points of convergence between the two, and some propose even their identity. This major shift in paradigm has occurred because of an overwhelming mass of new evidence that the recent research has brought to light. The present paper tries to underline a few of these pieces of evidence that are specially relevant to South Asian Protohistory.

Archaeological and genetic findings contradict the Aryan invasion/migration theory which formed the very basis of Vedic-Harappan dichotomy

Several scholars now do not believe in the arrival of the Aryans in South Asia from outside and they discard the existing linguistic paradigm that fosters this notion. Enough arguments have been given to prove that the Aryan invasion/migration theory is wrong. We need not repeat them here. Those interested may refer to a recent publication enumerating as many as 'seventeen arguments why the Aryan invasion never happened' (Feuerstein *et al.* 1995) and a 1999 update on the Aryan invasion debate (Elst 1999) is also available. We will confine ourselves only to a few archaeological and biological pieces of information that have significant bearing on the issue.

As is well-known, the Harappans used copper extensively, but they used bronze also which they produced by alloying copper with tin to harden the metal. While copper was readily available to them in abundance, tin was considered to be a precious commodity as it had to be procured from Khorasan and the area between Bukhara and Samarkand (Chakrabarti 1979: 70; Asthana 1993: 276-78). After the decline of the Harappans, tin-based bronze objects are not found in India for more than a millennium. No tin-based bronzes are reported from Copper Hoards and Painted Grey Ware assemblages, and Ahar and Kayatha complexes also do not have them (Agrawal 1971, 1974). It is evident that the earlier contacts with the areas of Baluchistan and Northern Afghanistan from where tin was obtained were severed. Kenoyer (1995: 230) puts the point-blank question: "In earlier models, the north western regions were the source of the so-called movements of Indo-Aryan-speaking people. Yet, if there were such movements, why were the migrants not supplying one of the most important raw materials for bronze production, i.e. tin?"

Another noteworthy fact is the conclusion arrived at by Hemphill *et al.* (1991) after detailed examination of biological adaptations and affinities of Bronze Age Harappans. According to this, only two biological discontinuities are observed within the Indus Valley: the one between 6000 and 4500 B.C. and the other sometime between 800 and 200 B.C. In the intervening period between 4500 B.C. and 800 B.C., the biological make-up of the people living in the area remained fairly constant. "In such a situation", B.B. Lal (1997: 287) rightly wonders, "how can one envisage the entry of hordes and hordes of Vedic Aryans who are supposed to belong to an alien, non-Harappan, biological group around the middle of the second millennium B.C.?"

The possibility of a second millennium B.C. arrival of Aryans in India is ruled out once again by an analysis of Indian and Western Eurasian gene pools. It is a well-known procedure in genetics to measure genetic inheritance, that is, transmission of characters from generation to generation by an analysis of mitochondrial DNA called mt-DNA. Using this method, Kivisild (1999) found that a key mt-DNA of Western Eurasian strain, which accounts for over 70 percent in the populations of European countries like Germany, is merely 5.2 percent in Indian populations. This study leads him to remark: "The supposed Aryan invasion of India 3000-4000 years before present, therefore, did not make a major splash in the Indian gene pool. This is especially counter-indicated by the presence of equal, though very low, frequencies of the Western Eurasian mt-DNA types in both southern and northern India" (Kivisild 1999: 134). The inference is quite clear: the much-propagated theory of Aryan invasion/migration is contradicted by genetics.

There is yet another piece of new evidence which is extremely significant in this connection. Referring to authoritative technical studies on animal anatomy and taxonomy, Manansala (2000) has shown that the Indian horses with only 17 pairs of ribs constitute a category different from that of the Iranian, Central Asian and European horses that have 18 pairs of ribs. That, this difference between Indian and northwestern horses existed in the Rigvedic times too, is demonstrated by him on the testimony of *Rigveda* (1.162.18). which informs: "The axe penetrates the thirty-four ribs of the swift horse; the beloved of the gods, (the immolators), cut up (the horse) with skill, so that the limbs may be unperforated, and recapitulating joint by joint" (Wilson 1990: 98). We have scrutinized the translation of the original verse occurring in context of a horse sacrifice. There is absolutely no ambiguity about the number of ribs (*vankrih*) which is clearly stated to be 34 (*chatuhtrinsat*). The evidence proves beyond doubt that the Rigvedic horse was of the indigenous variety and quite different from northwestern horses. This obviously does not fit with the notion of the arrival of Aryans on horse back or in horse-drawn chariots from Europe, Central Asia or Iran.

Vedic Aryans, a reality; Indo-Aryans, a myth

Scholars have often confused the Vedic Aryans with the Indo-Aryans forgetting the fact that the two are different designations. 'Arya' being the self-designation of the Vedic people, 'Vedic Aryans' represents a historical reality. As against this, the term 'Indo-Aryan' is a linguistic construct denoting the speakers of a subgroup of languages within the Indo-Iranian branch of the Indo-European family, and being a construct, its validity is subject to verification.

The linguistic theory, which tried to explain language distribution in terms of successive stages of population movements, is in crisis today. The proponents of the theory have now modified their stand; they are talking about migrations in place of invasions. But, any migration capable of creating a language replacement has to be sizable enough to leave behind at least some trace in the archaeological record. But that is not in sight.

In fact, the situation represents a clear case of Kuhnian 'paradigm in crisis' (Kuhn 1962: 84). The old theory of Aryan invasion/migration that sought to explain both, the language distribution and the archaeological bronze-to-iron transition in South Asia, is crumbling down under the pressure of growing intellectual dissatisfaction, while what is emerging is still in the melting pot. Several paradigms are struggling to take the place of an established paradigm. The main point of contention is the role of population movements in South Asian protohistory. While a few scholars like Allchin (1995: 41-42) still insist on the importance of population shifts, several others like Shaffer (1984,1986) have shown that the protohistory of South Asia can be fully explained within the context of internal dynamics of the cultures in the region without unnecessarily believing in an imaginary arrival of populations from outside. There is yet a third school of thought which maintains that population movements that brought about cultural changes emanated from South Asia itself (Talageri 2000). If the paradigm advocated by J.G. Shaffer, partly accepted by several other scholars like George Erdosy and J.M. Kenoyer, gains the ground, which appears to be the most likely outcome of current paradigmatic conflicts, the concept of 'Indo-Aryans' would be relegated to the domain of myths.

Rigvedic and Early-to-Mature Harappan geographical horizons coincide

The Rigvedic people and the Early-to-Mature Harappans have the same core area, namely, the region between the rivers Sarasvati and the Indus. As we have shown elsewhere (Singh 1997-98b), the Rigvedic culture originated in the Sarasvati Valley and extended towards the lower Indus area. The Harappan culture too seems to have arisen in the same valley by a fusion of Bagor, Hakra and Kot Diji ethnic groups (Shaffer and Lischtenstein 1989: 123).

Furthermore, the colonies and outlying settlements in different directions, northwest, east and southwest of both the Rigvedic and Harappan cultures have almost a congruent geographical coverage. The Mature Harappan site of Shortughai in northern Afghanistan and the references to the river Kubha (Kabul) in the *Rigveda* (5.53.9 and 10.75.6) provide the evidence of contacts of respectively the Mature Harappans and the Rigvedic people with areas in Afghanistan. Similarly, while the Harappan assemblages at sites like Lothal, Surkotada and Dholavira prove the presence of the Harappans in Gujarat, the legend of the shipwreck met by Bhujyu described in the *Rigveda* (1.116.3-5) points to at least the Kachch area (Nandi 1994-95: 33) as the southwestern extension of the Rigvedic domain. The name of the Rigvedic seafarer, Bhujyu, is significant for it connects him directly to the Bhuj area in Gujarat.

Relative position of the Rigvedic and Harappan chronological horizons: the debate continues

While several scholars are still insisting on a post-1500 B.C. date for the *Rigveda,* some others are trying to argue that the text cannot be later than 3750 B.C. However, a detailed examination of the various pieces of evidence shows that the truth lies somewhere in between the two extremes. Considerations of space do not allow us to deal with this problem at length, but we may, nevertheless, refer to a few weightier arguments that have been offered or could be offered in this connection.

The viewpoint of the 'late-daters'

We cannot brush aside the opinion favouring a post-Harappan time-span for the composition of the *Rigveda* simply by showing that it is a 'product of colonial-missionary outlook' nor by arguing that it was based on the Aryan invasion theory which is now proved to be a myth. Though a motive behind an opinion is obvious and irrefutable, the validity of the opinion can be challenged only by showing that the logic behind it (the evidence and arguments on which it is based) is false. Similarly, the fact that the Aryan invasion/migration theory is wrong, though weakens the force of the opinion, does not falsify it because the opinion was not based *only* on that theory. Scholars like Erdosy (19995) do not believe in the arrival of Rigvedic Aryans from outside, but they do agree with the post-Harappan dating of the *Rigveda*

I certainly cannot subscribe to this post-Harappan dating (Singh 1997-98a, 1997-98b) which is 'hypothetical, and purely arbitrary' (Winternitz 1991: 293). However, it could be agreed upon that more research work is needed to produce necessary evidence to finally disprove it. The only argument that really matters is the one based on the evidence of the date of drying up of the Rigvedic river Sarasvati. If it is certain that the river completely dried up by 1750 B.C. the *Rigveda* which describes it flowing in all its majesty, can never be taken to be post-Harappan (Singh 1997-98a). Further research is needed also to contradict the linguistic and archaeological evidence on which the late dating of the *Rigveda* is still insisted upon (Sharma 1995; Witzel 1995a, b). The one way is to meet the linguistic evidence by counter-indicative linguistic evidence. The other is to further develop the argument given by Sri Aurobindo (1971) that the science of linguistics is not developed enough to deduce the inferences that it claims to have deduced. The few archaeological pieces of evidence that have been advanced must also be answered. One such argument relates to the claim that the horse *(Equus caballus)* was absent from India before c. 2000 B.C. (Witzel and Farmer 2000). It would be worthwhile in this connection to examine the conclusion arrived at by Manansala (2000) referred to earlier that the Indian horses formed a different category pertaining to and descending from *Equus sivalensis.*

Coming now to the other extreme, the dating of the *Rigveda* to a pre-3750 B.C. horizon, we find that its proponents N.S. Rajaram, David Frawley and others base their thesis on the equation of the Harappan and *Sutra* periods. The main arguments (Sethna 1981; Rajaram and Frowley 1995) are: (a) the ancient Egyptian and Babylonian mathematics is derived from the *Sulbasutras,* and (b) this mathematical evidence is supported by astronomical considerations regarding Alpha-Draconis pole star, Krittika vernal equinox, and the time taken in the shift of the cycle of seasons from the days of the *Sutras* to the present. Additional evidence for the proposed chronology is provided by the stand that the Rigvedic period ended with the Battle of Ten Kings that is calculated to have occurred in 2730 B.C.

I have discussed these pieces of evidence in detail elsewhere (Singh 2001). It can be seen that the arguments are quite weighty and there is no doubt that the *Sutras* contain information of very early period. However, as in the case of the *Puranas*, so also in the cases of the *Sutras* and several other ancient Indian texts like the *Satapatha Brahmana*, *Ramayana* and the *Mahabharata* very often there is a very wide gap between the times of the contents and the times of the composition. A floating mass of literature existed in ancient times as it does even today. It is probable that the authors of the *Sutras* codified the knowledge that was handed down to their age from earlier times adding to it something of their own age too. Moreover, it is not necessary to believe in a monogenetic origin of mathematics at a single place for identical needs and situations could have generated similar ideas at different places at various points of time. The astronomical information also must have come down from earlier times and sources. We may refer in this connection to the opinion (though we do not agree with it) that the information about cold Polar climate has entered the Indian mythology through Iranian-Scythian contacts (Bongard-Levin and Grantovsky 1968).

In my view, the end of the composition of the Rigvedic hymns and the decline of the Harappan urbanization were caused by the same ecological dislocations mainly those caused by the drying up of the river Sarasvati.

The river dried up because its two most important tributaries, the Yamuna and the Sutlej, were captured by the Gangetic and Indus systems respectively (Misra 1984, 1994). This resulted into large-scale community movements from the Indus-Sarasvati region to locations east and southeast. In literature, it is evidenced by the shift of centre(s) of activities from Saptasaindhava area to new geographical horizons designated as Brahmavarta and Aryavarta successibly. In archaeology, this shift is demonstrated by regional population movements recently well-documented by Shaffer and Lichtenstein (1999). However, though the end points of the two coincide, the beginning of the *Rigveda* (its subject matter, though not its form) antedates even the Hakra Wares Culture (Singh 1997-98a).

The mosaics of the Rigvedic and Harappan cultural contacts have striking resemblance

The Rigvedic and Harappan cultures have many points of convergence. We have already referred to their identical geographical horizons and partial synchronism. Remains of fire-altars and horse have been found at several Harappan sites (Gupta 1996: 151-63). Some Harappan pottery types find mention in the Vedic literature (Singh 1969). Long distance trade by land and sea is evidenced by several Rigvedic hymns (Singh 1995: 227-80). Parallelism between Vedic and Harappan town planning is noticed (Bisht 1989-90). In fact, several scholars like Bhagwan Singh (1995, 1997) forcefully advocate the Vedic-Harappan identity.

Enough evidence has now come to light to conclude that the Rigvedic Cultural Tradition and the Harappan Cultural Tradition down to the end of the Mature Harappan Phase represent one and the same tradition. This tradition later shifted forwards the east, a fact which is shown by both literature and archaeology (Shaffer and Lichtenstein 1999). After this shift in geographical focus, the Middle and Late Vedic cultural traditions developed involving both continuity as well as change, and the post-Mature Harappan assemblages down to the PGW phase provide the archaeological traces of these cultural developments.

Vedic-Harappan connections can be properly defined only on the level of ethno-geographic configurations

The time has come that we elaborate the one-to-one correspondence between the literary and archaeological pictures of these ancient Indian cultural developments. For this, we may fruitfully use the concepts of 'cultural traditions' and 'ethnicity' as developed and adopted by scholars like Shaffer (1992) and Shaffer and Licutenstein (1995). Both, the *Rigveda* and the early South Asian protonistoric assemblages evidence the existence of several ethno-geographic configurations. Their correlations must be worked out to fully understand the Rigvedic and Harappan connections.

It may be noted that the considerations that define the Harappan and Rigvedic cultures are not exactly the same. It is basically the rise, intensification and collapse of an urban process that defines the Harappan Culture. As against this, it is an emerging ideology based on sacrificial ritual that constitutes the hallmark of the Vedic Culture. This leaves one in dbout also whether all the social groups that participated in the process of Harappan urbanization also shared the Aryan ideology. Similarly, it may not be stated with certainty if all the ethnic units that had come within the Aryan fold necessarily involved them with the Harappan urban process. Several of the Kot Dijians, as we know, joined the Harappan fold while some of them kept them aloof.

It is at this point that the concepts of 'cultural tradition' and 'palaeoethnicity' become relevant for South Asian archaeology. A 'cultural tradition' is developed through the creation of an 'interaction system' within the context of temporal and geographical continuity in which sets of seemingly diverse social groups called 'phases' participate. When these social groups generate new social identity in order to become more effective, they are called 'palaeoethnic groups'. It is these palaeoethnic groups that we designate as 'ethno-geographic configurations'. In our opinion, the Rigvedic and Harappan connections can be properly defined only on the level of these ethno-geographic configurations. Evidently, much research work has still to be done before we pronounce any final judgment on this issue.

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A Human Skeleton Discovered from the Rock Shelter Site of Deulga Hills (District Sambalpur), Orissa

S.R. Walimbe, Pradeep K. Behera[1] and Veena Mushrif

Department of Archaeology
Deccan College
Pune 411 006

1 Department of History,
Sambalpur University, Sambalpur,
Orissa

Abstract

Extensive explorations were undertaken in the rock shelter sites of Deulga Hills (District Sambalpur, Orissa). In order to understand the nature of habitation inside the rock shelters and the archaeological context of the rock art of the Deulga Hills, a trial pit was laid on the floor of one of the shelters. Three broad layers of habitation could be identified, of which layer 2, presumably belonging to the Late Mesolithic phase, yielded a human burial. This young adult, probably female, is very short in stature and exhibits general gracility in cranial and post-cranial features. The gracility of this specimen might be because of the genetic makeup of the individual, or because of less mechanical stress on females expected during the pre-agricultural levels. Some interesting pathological lesions and anomalies have also been noticed, including vertebral fusion, foramina of vertebral body, rib deformity and dental pathologies.

Introduction

Extensive explorations and limited excavation were undertaken by the second author (PKB) in the rock shelter sites of Deulga Hills in the Rairakhol subdivision of Sambalpur district (Orissa) during the field seasons 1999-2000. The study area (218 08' to 218 15' N; 848 35' to 848 45' E) lies in the western part of Landimal Reserve Forest and comprises of a series of hills of low to medium heights (Fig. 1 and 2). The area is drained by the Khalbala and other smaller streamlets, which carry water mostly during the wet season. The river Tikra, which is a major tributary of the Brahmani, forms the northern boundary of the area surveyed.

The investigations have brought to light a large number of rock shelter sites, lying generally on the top of the low hills or in the well developed scarp faces in the middle portion of large hills. More than a hundred small- and large-sized rock shelters were discovered, of which fifteen yielded evidence for prehistoric habitation. These shelters measure between 18-28 m in length, 4-8 m in depth, and 6-7 m in height. The walls of these shelters contain a wide array of petroglyphs while microliths, heavy-duty pebble tools, crudely-made potsherds are found on the floors of most of the shelter. A large number of conical as well as cylindrical cupules, often occurring in alignments occur on the rocky floors. The rock art of Deulga Hills consists mainly of petroglyphs, mostly engraved, or abraded/scratched, or rubbed on the front wall. The unique feature seen in this art is the naturalistic as well as schematic representation of a variety of animal forms including fish and birds.

In order to understand the nature of the habitation inside the rock shelters and the archaeological context of the rock art of the Deulga Hills, a trial pit measuring 1 m x 1 m was laid on the floor of one of the shelters (No. 2), located about 6 km south-east of Hitasara village (Fig. 3 and 4). This shelter measures 28.25 m in length, 7.51 m in depth and 6.61 in height.

On the basis of soil colour, composition and cultural material finds, three broad layers of habitation could be identified. Layer 1 (0-20 cm) is composed of reddish coloured, loose, silty-sand, mixed with exfoliated sandstone fragments. The cultural material recovered includes lithic assemblage (microlithic and non-microlithic), a few crudely made and shapeless potsherds, freshwater mollusc shells of bivalve variety, and a few fragments of animal bones. Layer 2 is between 20-45 cm, formed of reddish brown, loose, silty-sand mixed with occasional sandstone fragments and calcretes. The material finds from this level include lithic assemblage, microlithic as well as non-microlithic, upper part of a bone point, mollusc shells of bivalve and gastropod types, a few pieces of animal bones, and most importantly, human skeletal remains. Layer 3 (45-63 cm) is of brownish-grey, loose, silty-sand mixed with a few sandstone fragments and calcium carbonate nodules. The cultural assemblage from this layer includes lithic artefacts, mollusc shells, a few pieces of animal bones and several pieces of foliated mica.

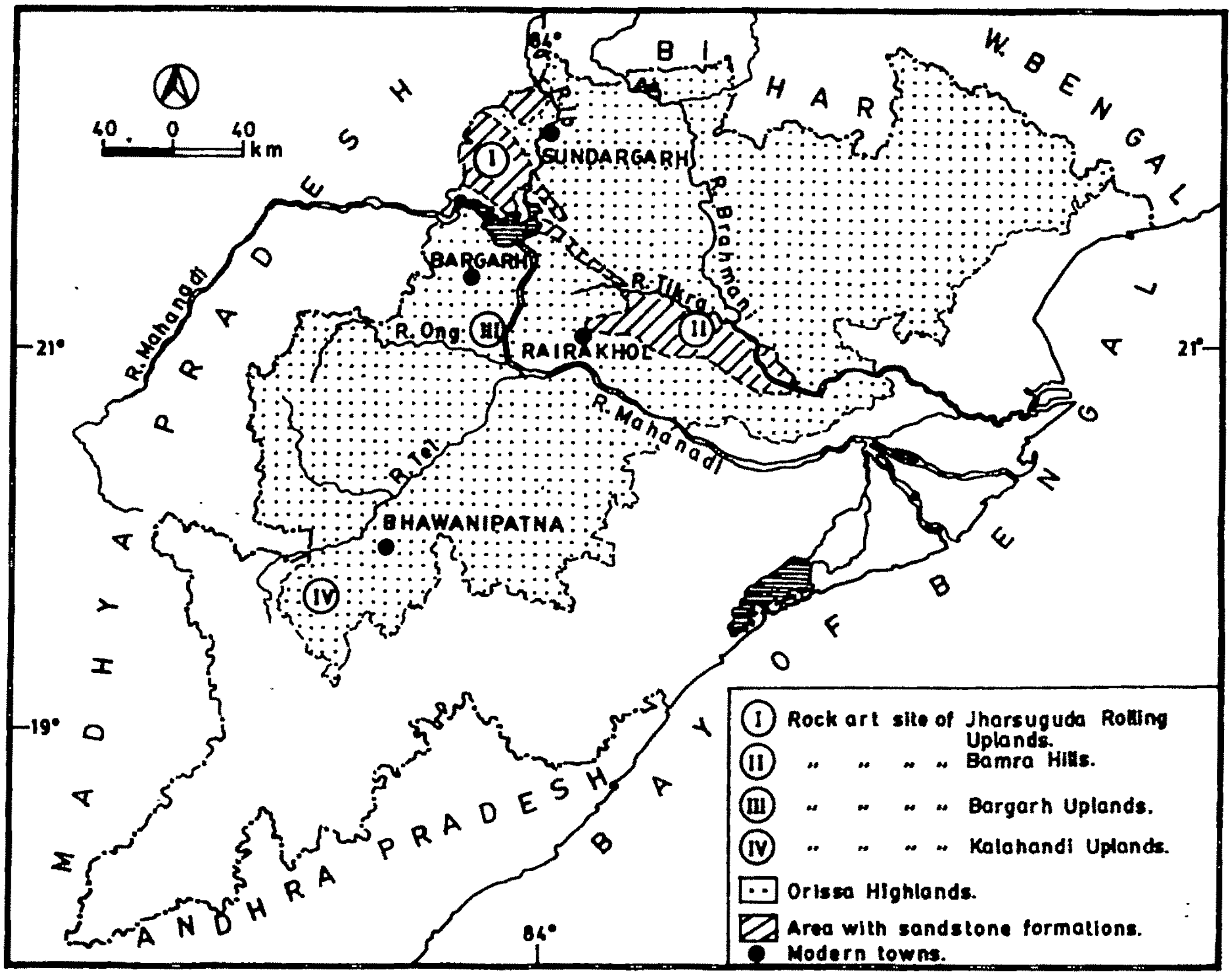

Fig. 1: Distribution of rock art complexes in four sub-geographical regions of Orissa highlands

The human skeletal remains were studied at Deccan College Post-Graduate and Research Institute, Pune by the first author (SRW) with the technical assistance of the third author (VM). The study was undertaken during June-July 2000. This article gives the details of the anthropological investigations carried on this skeletal collection. Detailed report on the exploration and excavation in archaeological perspectives is being published separately by the second author (PKB).

Skeletal Inventory and Preservation Condition

Various parts of the body, apparently of a single individual, are represented in the collection. They were found randomly distributed throughout the 20-25 cm thick deposit of layer 2 (Fig. 3). Improper anatomical orientation of the skeletal remains could be because of 'secondary' nature of burial, or post-burial rodent activity, or some other disturbance. However, it needs to be noted that only on one small-sized cranial fragment charring marks are evident resulting in discoloration of both the inner and outer table. No other bone exhibits such discoloration or warping or cracking which is normally expected if the body is exposed to fire in 'flesh-on' or 'green' condition (for example, cremation or accidental exposure to fire). There are no gnawing marks on any bone to attribute the disturbed state of burial to rodents either.

Though the state of preservation is fragmentary, the elements exhibit minimal amount of weathering. However, all the elements are heavily coated with calcareous matrix, which is difficult to remove. This precludes reconstruction of the vault, detailed morphological observations and correct diagnosis of pathological lesions. Many fragments have fresh breaks and it is very unfortunate that the remaining respective portions of bones are missing in the collection.

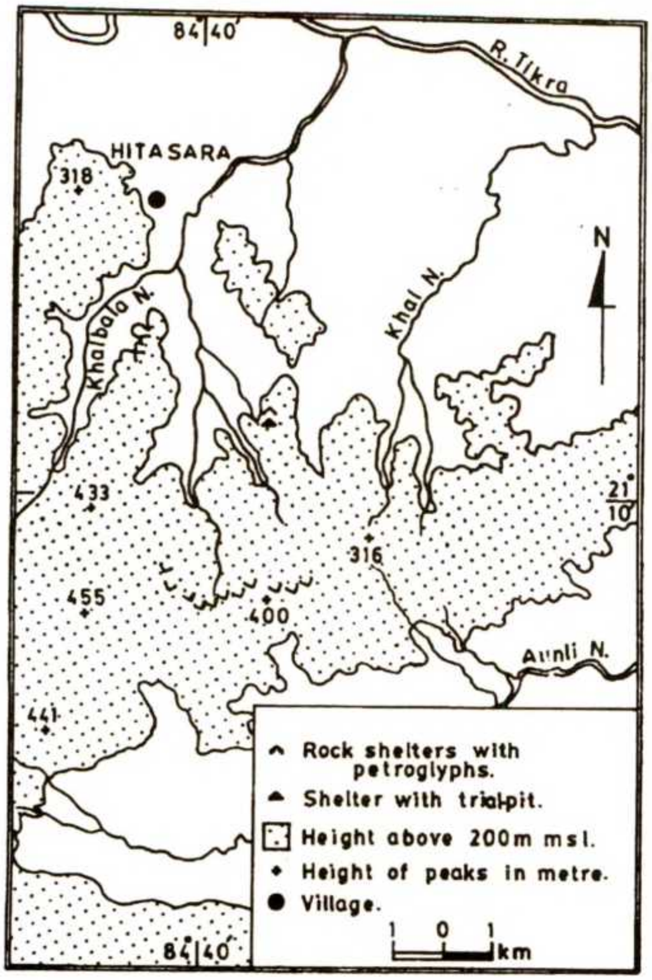

Fig. 2: Map showing the rock art sites of Deulga hills

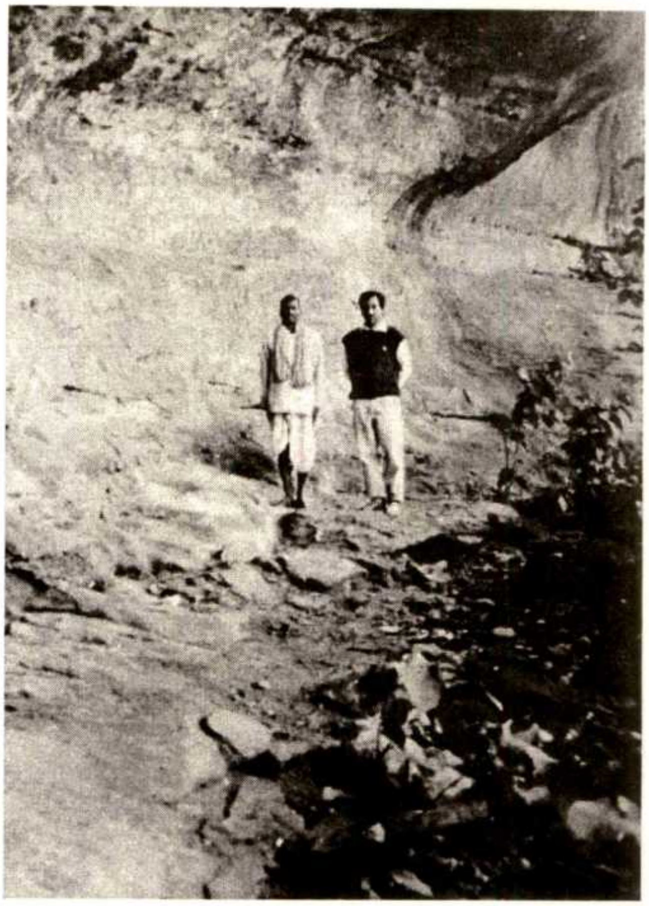

Fig. 3: Shelter No. 2, where trial pit was taken

The skeletal elements made available for study includes the followings:

Skull

Major cranial collection comprises of small- and medium-sized fragments of the frontal, right and left parietal, temporal, and occipital. Identifiable fragments include a portion of the right maxilla and zygomatic which retains the lower and lateral margin of the eye orbit; right and left petrous portions of the temporal without mastoid processes (left one of the two is better preserved with squamous portion); basi-occipital with the right side of foramen magnum.

Dentition

Right maxillary dental arcade is present with all teeth from I1 to M2 *in situ*. The third molar, RM3, is lost post-mortem. Left first incisor is also present in its crypt and is held with the right maxillary bone. Mandibular fragment of the symphyseal region with six anterior teeth, RLI1, RLI2 and RLC, all *in situ*, is preserved. Also preserved is the right ascending ramus with undamaged coronoid and condyle.

Thoracic Cage

Rib collection includes the vertebral ends of four ribs, and 23 mid-shaft fragments. Owing to the small size of the fragments, individual identification is difficult. Elements from the vertebral column are the left half of third cervical, four transverse processes and a few body fragments of the thoracic, posterior side of two lumber vertebrae, two bodies of the lumber region, and nine fragments consisting of vertebral spines and articular facets.

Upper Extremities

Sternal half of the right clavicle, two fragments of the right scapula (one with complete glenoid cavity, almost entire spine with partial acromion, and the other one with three-fourth of axillary border with inferior angle) are the only elements from the pectoral girdle. Complete left humerus having both extremities well preserved, and proximal half

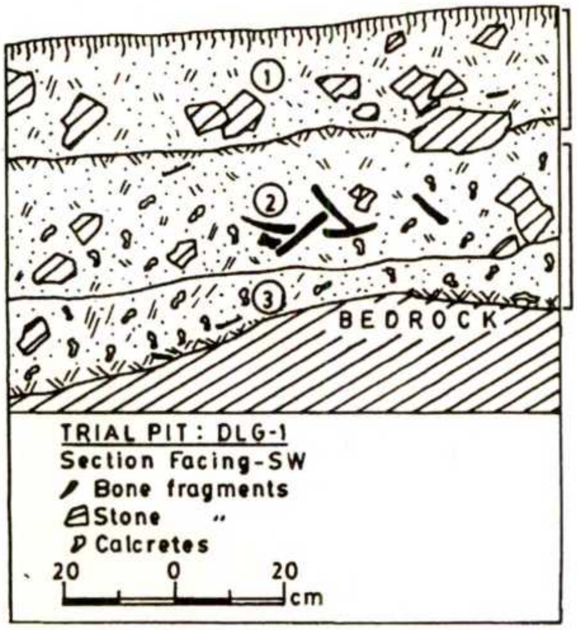

Fig. 4: Section from trial pit (Shelter 2)

of the left ulna, and proximal shaft portion of the left radius (adhered to ulna) are the long bones preserved. Radial head is broken and missing.

Lower Extremities

No bone of lower extremities is present in the collection.

Description

The most significant feature of this individual is its short stature and general gracility. The left humerus is complete and measures 24 cm in length. Using Trotter-Gleser formulae (Trotter 1970) stature estimation would be in range of 144.37" ± 4.05 cm (if male) and 138.61" ± 4.45 cm (if female). It would be of interest to note that this is one of the shortest adults known so far amongst the Indian prehistoric/protohistoric populations. The mean statures for the Mesolithic Sarai Nahar Rai and Mahadaha males was 181.47 cm and 181.69 cm, respectively, while the Deccan Chalcolithic populations were relatively short, with a mean stature of 172.48 cm (Kennedy *et al.* 1986, 1992; Walimbe and Tavares 1995).

The specimen is delicately built. Orbital margins, temporal lines, nuchal area and the mastoid region are considerably small and smooth. Points of muscle insertion on long bones (i.e. greater and lesser tuberosities, neck and deltoid tubercle as well as distal condylar area in humerus) are delicate. Dental size is also small owing to the small-sized jaw (see Table 1). Smaller gnathic bones have also resulted in slight dental crowding of the teeth in both, maxilla and mandible.

Sex determination for this specimen remains uncertain, but even for female sex the robusticity expression is far less than expected as per the standards known for the Indian archaeological skeletal populations. Skeletal gracility, besides sexual dimorphism, in general, can be attributed to three possible reasons: nutritional inadequacy, pathology, or genetic make-up of the population. Though there are a few palaeopathological lesions or anomalies seen in this specimen, most of them are age related and not known to have any influence on growth during the developing phases of life. Less mechanical stress also will not be enough to justify the degree of gracility expressed in this individual.

Two basic measurements have been carried out for each tooth following the Moorrees' (1957a, 1957b) technique. These consist of maximum crown length (mesio-distal diameter) and maximum crown breadth (bucco-lingual diameter). The mesio-distal diameter (MD) is the maximum dimension of the tooth crown in the mesio-distal direction, parallel to the occlusal and the labial surface. The bucco-lingual crown diameter (BL) is the greatest distance between the buccal and the lingual surface of tooth crown in a plane perpendicular to that of the mesio-distal diameter. The crown measurements are carried out with electronic MAX-CAL digital caliper with an accuracy of 0.01 mm. The primary comparative standard in the analysis of tooth size is the crown area (CA) or the cross-sectional area of the tooth. This figure of crown size is obtained by multiplying the mesio-distal diameter by bucco-lingual diameter. It reflects the adaptive strategies of the population in response to the subsistence pattern and the level of technology. Since the dentition preserved for this individual is incomplete, no such comparisons are possible. The crown index (CI), a measure of crown shape is the ratio of mesio-distal and bucco-lingual diameter expressed in terms of percentage, as suggested by Wolpoff (1971). The measure of crown bulk, crown module (CM), is the average of mesio-distal and bucco-lingual values. Odontometric data is provided in Table 1.

The third molar was apparently fully developed as the crypt morphology suggests. However, its eruption status cannot be precisely judged. It was either fully erupted or only partially erupted. Non-eruption of third molar is often seen in small-sized gnathic bones. However, despite the smaller size of the maxilla in this individual, the tooth was not retained in the jaw and it was at least partially in use.

A few additional metric data could be generated on the long bones which is given in Table 2.

Table 1: Dental crown dimensions and indices

Tooth	Side	Crown Dimensions			Crown Indices	
		MD	BL	CA	CI	CM
Maxilla						
I1	R	7.18	6.44	46.23	111.49	6.81
	L	7.17	6.42	46.03	111.68	6.79
I2	R	6.06	5.32	32.23	113.90	5.69
C	R	7.09	8.13	57.64	87.20	7.61
Pm3	R	6.39	9.02	57.63	70.84	7.70
Pm4	R	5.25	8.96	47.04	58.59	7.10
M1	R	9.20	11.30	103.96	81.41	10.25
M2	R	9.15	10.77	98.54	84.95	9.96
Mandible						
I1	R	4.36	4.33	18.87	100.69	4.34
	L	4.36	4.37	19.05	99.77	4.36
I2	R	4.92	4.76	23.41	103.36	4.84
	L	4.96	4.77	23.65	103.98	4.86
C	R	5.48	6.68	36.60	82.03	6.08
	L	5.50	6.63	36.46	82.95	6.06

Palaeopathology

A few noteworthy palaeopathological lesions and anomalies are seen in this specimen. Confirmation of bone changes is not possible in many cases owing to the unsatisfactory preservation.

Vertebral fusion

One fragment from the collection includes superior and inferior facets, and broken spines of two lumber vertebrae (2nd and 3rd?). The articular facets appear to have fused, more convincingly on the left side, and probably on the right side too (Fig. 5). Accurate diagnosis is not possible for the right side because of the heavy matrix coating on the bone.

Fusion of the vertebral bodies or other parts of vertebra can be taken as a degenerative disease and age-related phenomenon. It occurs as a result of gradual deterioration of inter-verterbral discs because of increasing mechanical stress on the back portion (Robert and Manchester 1995). The bone changes in most of the cases are seen on the vertebral bodies. In this specimen, manifestation of the lesion in this region cannot be commented on since the relevant parts are missing. However, since the superior and inferior facets are affected, there is every ground to suspect some new bone formation in the vertebral body region, as well.

The manifestation of this disease might not have been serious in this individual, but probably resulted in confined movements of the back portion. Severity of vertebral

Table 2: Osteometric data

Measurement	Value (cm)
Clavicle	
Maximum length	(13.00)
Vertical diameter in middle	6.00
Sagittal diameter in middle	7.00
Girth in middle	2.40
Caliber index, robustness index	18.46
Cross-section index	85.71
Claviculo-humeral index	54.16
Scapula	
Length of axillary border	10.50
Length of glenoid fossa	2.70
Breadth of glenoid fossa	2.10
Depth of glenoid fossa	(0.1)
Length-breadth index of glenoid fossa	77.77
Curvature index of glenoid fossa	3.70
Humerus	
Maximum length	24.00
Total length of humerus	23.40
Breadth of proximal epiphysis	3.30
Breadth of distal epiphysis	4.50
Maximum diameter in middle	1.40
Minimum diameter in middle	1.10
Least girth of shaft	4.10
Girth in middle of shaft	4.30
Maximum transverse diameter of head	3.00
Maximum sagittal (vertical) diameter of head	2.30
Girth of head	9.50
Breadth of trochlea	2.10
Breadth of capitulum	1.50
Depth of trochlea	(0.90)
Cross-section index of shaft	78.57
Robusticity index, caliber index	17.08
Cross-section index of head	130.43
Trochlear epicondylar index	46.66
Ulna	
Girth of ulna	3.60
Breadth of olecranon	1.50
Height of olecranon	1.40
Height of olecranon cap	0.70
Olecranon height index	93.33

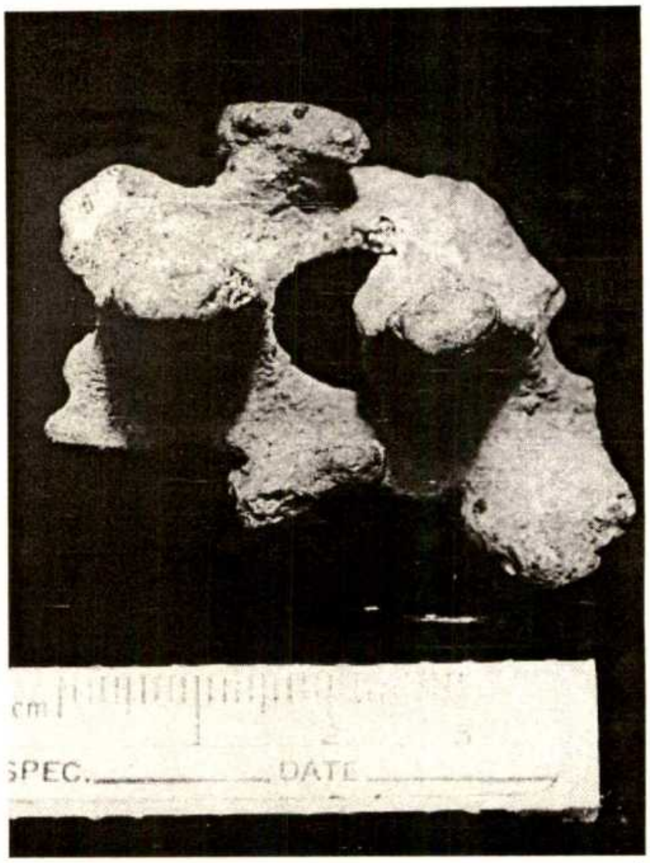

Fig. 5: Vertebral fusion

fusion was not high because of the relatively young age of this individual at the time of death.

Foramina on vertebral body

On one thoracic (?) vertebral body two foramina of smaller size are evident on the ventral aspect (Fig. 6). The surface of the holes looks smooth and indicates antemortem origin of the lesion. Spongy bone of the vertebral body is lost post-mortem precluding precise interpretation of the lesion. Other than these two holes, the bone fragment looks normal.

Rib deformity

One rib fragment of this individual appears to be slightly deformed (Fig. 7). Small amount of swelling is observed. Though worth recording, the lesion might not be a serious one as the bone change is almost invisible. It could very well be in the normal range of variation seen in the rib tubercle area. The size of a bone is also very small which restricts further interpretation of the lesion.

Dental crowding

Dental crowding in upper and lower jaw is visible for this individual (Fig. 8 and 9). The maxillary right first incisor

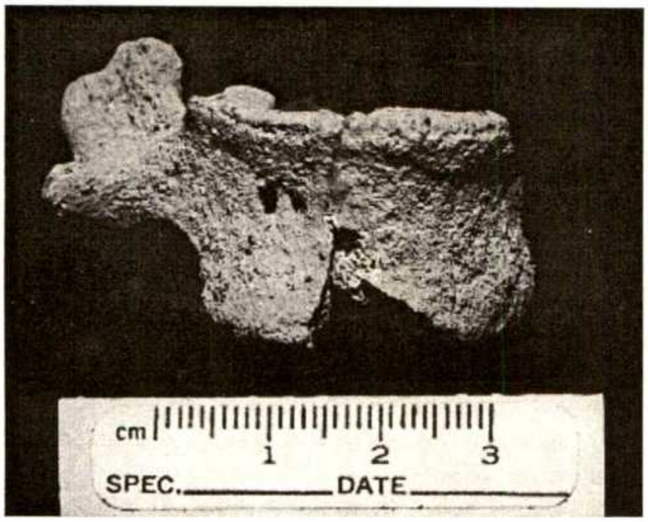

Fig. 6: Foramina on the posterior aspect of thoracic (?) vertebral body

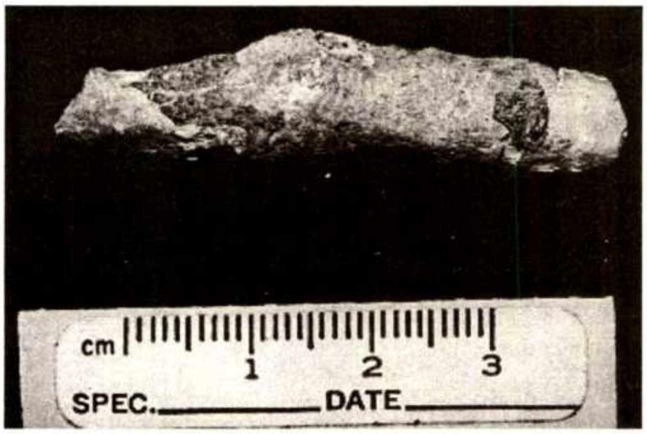

Fig. 7: Rib fragment showing slight deformity

and left second incisor of mandible are misoriented. Dental crowding occurs because of insufficient space in the jaw. Apparently, the jaw size of this individual is small.

Attrition

Moderate attrition is evident in both maxillary and mandibular teeth (Fig. 8 and 9). Maxillary premolars and molars show slight enamel wear. According to the standards (Buikstra and Ubelaker 1994) attrition on the first premolar is 'grade 5', in which two large dentine areas are exposed, and for the second premolar 'grade 4', where only one large dentine exposure on one cusp is seen. Wear pattern on the first molar is of 'grade 6' and that on the second molar is 'grade 4'.

It may be noted that attrition is a normal reaction of tooth to mastication of food and ageing process. The

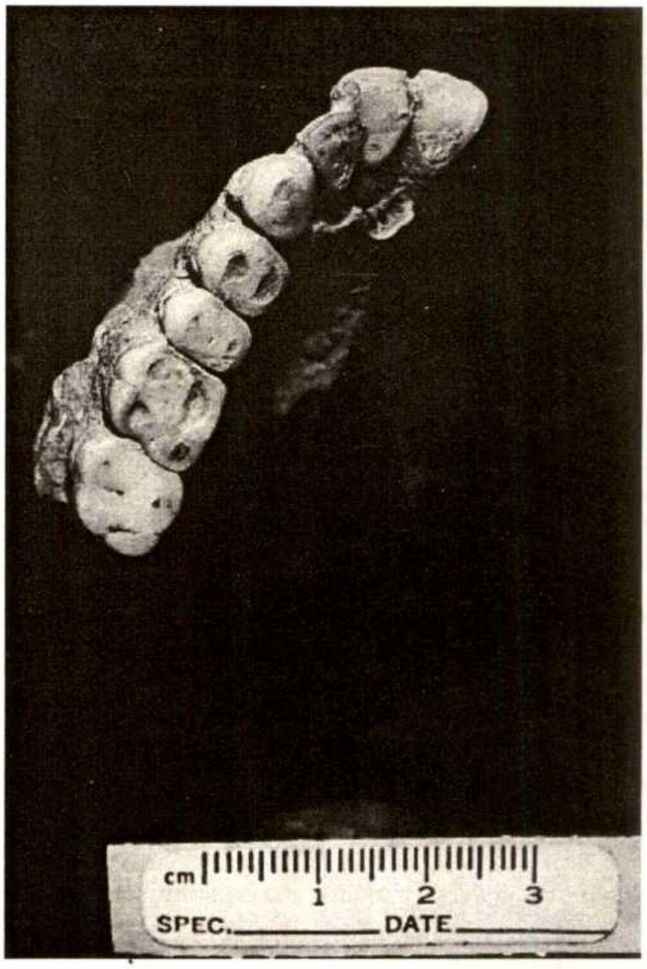

Fig. 8: Right maxillary fragment

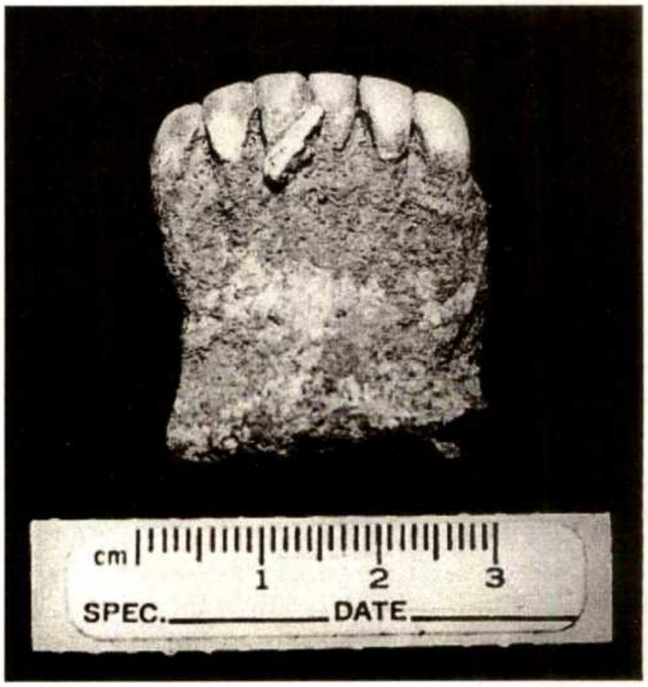

Fig. 9: Mandible

degree of attrition is based on the quality of diet and food preparation technique. If the food is coarse, attrition is more. During the Mesolithic phase, the food was coarse and probably uncooked, resulting in severe attrition. With the introduction of agriculture, the quality of food was changed and food preparation technique became more sophisticated. The skeletal remains from the Chalcolithic cultures give less evidence of severe attrition (Walimbe and Lukacs 1992).

Tartar accumulation

Slight tarter accumulation is seen on almost all the teeth from maxilla and mandible (Fig 8 and 9). Calculus deposition is a common irritant found in archaeological specimens. It consists of a sticky coating including protein, food particles, living and dead micro-organisms. When plaque mineralises, it becomes calculus and in this form can be found on archaeological skeletal specimens as relatively hard additions to the tooth surface usually at the margins of the gums. It develops some kind of irritation in the jaw. Tartar accumulation also indicates poor oral hygiene of an individual.

Age Estimation

Estimation of biological age at the time of death of this individual is to be based on long bone epiphyseal fusion, closure status of cranial sutures, and dental attrition.

Two preserved long bones, left humerus and ulna, provide information to determine the lower limit of the age estimation. In both the bones epiphyseal union was complete long before the death. Buikstra and Ubelaker (1994) give standard figures for long bone epiphyseal fusion. The fusion of humeral head starts at the age of 14 and the union is over between 18-22 years. The proximal end of ulna usually unites with the shaft at about 15 to 18 years in females and 19-20 years in males. This indicates that this individual was above 25 years at the time of death. Acromion process of scapula is also fused with the spine confirming this judgement.

In the right parietal fragment, part of the lambdoidal suture is preserved which shows status of complete enclosure in the lambda region. Sutural closure in this region generally occurs at the age of 26 years (Stewart 1979).

The two maxillary molars also provide clues for estimating age at the time of death. The first molar is moderately worn, with more than one-forth of quadrant area is involved but there is still much enamel present. The wear pattern can be rated as 'grade 6' following the Buikstra and Ubelaker (1994) standards. The second molar can be placed in 'grade 4', in which quadrant area is worn flat (horizontal) but there is no dentine exposure other than a possible pinprick sized dot. The third molar is lost and but apparently was erupted, partially or fully. Though the occlusal attrition pattern is closely correlated with the dietary habits, as stated above, the amount of enamel wear seen on these two teeth indicate an age of not less than 25-30 years.

The overall estimation of age at the time of death is around 25 to 30 years.

Sex Determination

No sexually diagnostic part is preserved in the collection. As stated above the bones are gracile in appearance, which probably suggests female sex of the individual. But confirmation of this comment is not possible owing to the loss of pelvic bones.

The degree of sexual dimorphism as expressed in skeletal robusticity is of high intensity in the pre-agricultural phase. Differential work demands placed on males and females are reflected in bodily features. In hunting-gathering communities, males are presumed to have activities that are more laborious and therefore tend to be more robust. The females who are mostly engaged in domestic activities are rather gracile. On the other hand, in agricultural populations the workload on males and females is almost equal. As a result, males tend to be more gracile and females more robust in comparison to their counterparts in the pre-agricultural stage, thus reducing the robusticity gap. This fact is supported by archaeological skeletal evidence where a higher degree of sexual dimorphism is evident in Mesolithic populations than in the later farming communities.

Concluding Comment

Limited archaeological excavation of the habitation deposit in one of the rock art sites of the Deulga hills have brought to light two broad phases of human occupation. The tool kit and the faunal remains recovered from the earlier phase indicate that the people in this period probably subsisted on limited hunting of small to medium-sized animals and aquatic as well as plant food resources. The association of human skeleton to this phase implies relatively heavy mechanical stress in comparison to the succeeding phase where there was greater emphasis on pastoral based subsistence economy.

In the absence of scientific dates, but depending on the circumstantial evidence, the second author assigns a time bracket of the late Mesolithic to the earlier phase, and advanced Neolithic to the later phase.

The gracility of this specimen is probably because of genetic makeup of the individual, but for the hunting-gathering pre-agricultural population, it could even be in the normal range for females. However, based on limited specimen no further comment could be forwarded. To have a broader understanding of the nature of biological adaptations and to evaluate the role of genotype further excavation work in the present area is highly recommended.

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Osteological Differences between Blackbuck (*Antilope cervicapra*), Goat (*Capra hircus*) and Sheep (*Ovis aries*)

Seema J. Pawankar[1] and P.K. Thomas[2]

1 Department of Archaeology
Jahangirnagar University
Savar, Dhaka
Bangladesh

2 Department of Archaeology
Deccan College
Pune 411 006

Abstract

Distinguishing between various ruminants of similar size from fragmentary bones found at archaeological sites is a difficult task. In this paper we give certain qualitative markers in the post-cranial bones which make it possible to distinguish between sheep, goat and blackbuck, which may be of use to other workers in the field.

Introduction

The study of faunal remains from archaeological sites is an integral part of archaeology for the reconstruction of food economy, environment, preference of animals, season of occupation of a site, cultural contacts, social status, social customs of ancient populations. It has been found that bones collected from archaeological sites tend to be very fragmentary, mainly because of human activity on the carcass of the animals, unless it is natural or intentional burials of animals. The identification of such fragmentary bones especially of the smaller ruminants becomes difficult especially when one works without the help of proper reference skeletons of these animals. A flaw in identification can change the entire scenario of archaeological interpretations. The bones of smaller ruminants with human activity from archaeological sites are often misidentified because of their close morphological similarities and also similar size range. The group of medium sized mammals has several species of the same size range, such as sheep, goats, blackbucks, chinkara and other small deer species. The post-cranial morphological distinctions between sheep, goats and the blackbucks are studied. Many western zooarchaeologists have tried to understand the osteological differences between sheep and goats (Boessneck 1963; Prummel and Frisch 1986). The blackbucks (*Antilope cervicapra*) belong to the sub-family Antilopinae and sheep (*Ovis aries*) and goats (*Capra hircus*), to the sub-family Caprinae. We detected certain qualitative markers in the post-cranial bones to distinguish between the three species, which will be useful for those who are engaged in faunal analysis from archaeological sites.

Materials and Methods

Osteological differences between blackbucks, sheep and goats have been worked out with the help of the reference skeletons of the above mentioned species housed in the Archaeozoology Laboratory of the Deccan College Postgraduate and Research Institute, Pune. Measurements and available literature were also used for comparative analysis. Other than the morphological criteria, these species could also be separated out with the help of metrical analysis (Joglekar 1991). For metrical analysis, measurements of the modern reference skeletons and skeletal remains of the above-mentioned species from Inamgaon, a Chalcolithic site in Pune district of Maharashtra were used. In the following discussion various skeletal elements and their distinguishing characters are given.

Mandible

1) The shape of the mandible is similar in blackbucks and goats but distinct in sheep. 2) In blackbucks, the portion between the mandibular symphysis and the second premolar is flat, thin and long and in sheep and goats it is rounded, thick and short. 3) The mental foramen is away from the second premolar and nearer to the symphysis in blackbucks and it is closer to the second premolar in sheep and goats. 4) The mandible is very thin in blackbucks while it is thick in sheep and goats. 5) The shape of the coronoid process of mandible is distinct in all the three species (Fig. 1).

Scapula

1) The overall shape of the scapula is long, narrow and elongated in blackbucks. In sheep and goats the scapula is broader. 2) The spine goes straight upward in blackbucks,

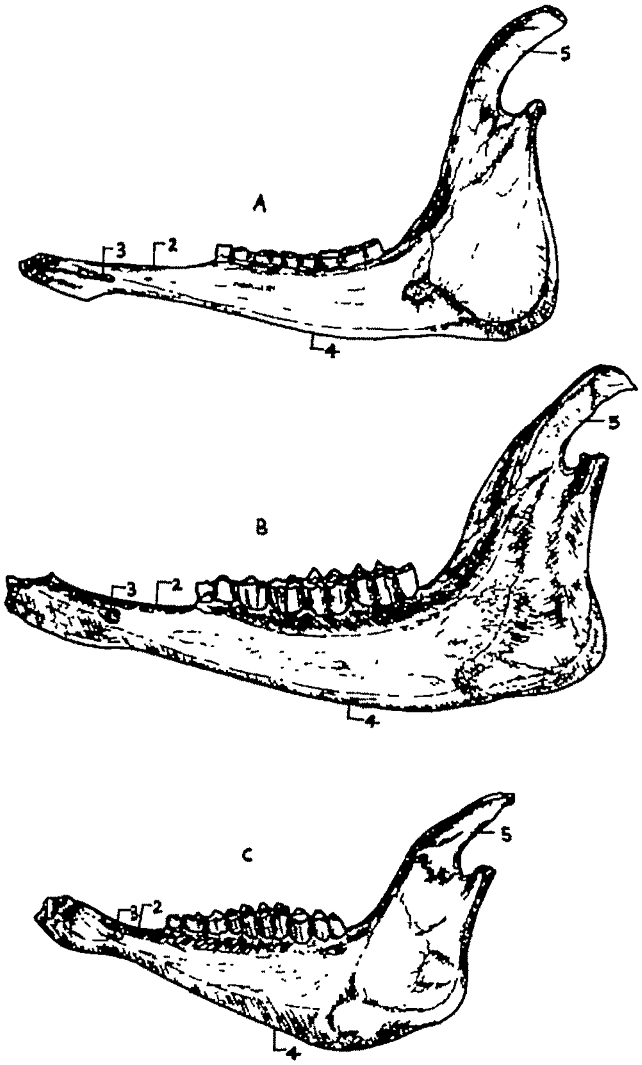

Fig. 1: Mandible: Difference between A. *Antilope cervicapra*, B. *Capra hircus* and C. *Ovis aries*

while it is slightly turned towards the anterior border of the scapula in sheep and goats. 3) In blackbucks the neck region is long and slender. It is long and broad in goats, short, and thick in sheep. 4) The distance between the glenoid cavity and spine is shorter in blackbucks than in sheep and goats. 5) On the posterior side of the neck region, a dent is visible in blackbucks while it is flat in sheep and goats. 6) The glenoid cavity is deep in blackbucks and shallow in sheep and goats. 7) The tuber scapula is thin and curved in blackbucks and thick and broad in sheep and goats. 8) The anterior and posterior edges are sharp in blackbucks and are blunt in sheep and goats. 9) In blackbucks, from the medial side the spine is not visible but in sheep and goats it is visible. 10) In the neck region, the anterior and posterior borders are straight in blackbucks and goats. The anterior border is curved in sheep. 11) On the posterior border of the neck region a prominent muscle striation is noticed in blackbucks. This is less prominent in goats and is absent in sheep (Fig. 2a and 2b).

Measurements of the greatest length of glenoid cavity and the breadth of glenoid cavity of scapula have been used to differentiate these species (Fig. 2c).

Humerus

1) The shaft of the humerus is shorter in length in blackbucks, slender in sheep and thick and long in goats. 2) The head is more elongated in blackbucks and more flat in sheep and goats. 3) The tuberculum majus cranial is small and broad, it does not project upward from the shaft and the angle with the articular surface is less in blackbucks. In sheep and goats the tuberculum majus cranial projects upward from the shaft itself and is long and broad. The angle with the articular surface is greater in blackbucks. 4) The neck region is more curved in blackbucks than in sheep and goats. 5) The deltoid ridge is sharper in blackbucks than in the sheep and goats. 6) The lateral and medial epicondyles are in the same plane in blackbucks. In sheep and goats the medial epicondyle is higher than the lateral epicondyle. 7) The olecranon fossa is wide open in sheep and blackbucks and is slightly closed in goats. 8) The shaft above the olecranon fossa, towards the proximal side is raised up in blackbucks, flat in goats and slightly raised up in sheep. 9) In blackbucks, the lateral and medial epicondyles terminate where the lateral and medial condyles end. In sheep and goats both the epicondyles terminate where the olecranon ends. 10) The condyles merge with the coronoid fossa in blackbucks and in sheep and goats a distance is maintained between the condyles and the shaft that make a deep and wider coronoid fossa. 11) The shaft is more curved near the distal end in blackbucks than in the sheep and goats. 12) The groove on the medial condyle is deeper in blackbucks than in the sheep and goats. 13) The medial epicondyle extends straight distally beyond the medial condyle in blackbucks. In sheep and goats it extends to the level of the medial condyle. 14) Metrically, the thickness and the width of the distal ends vary in all the three species. 15) There is a depression on the tuberculum majus on the cranio-lateral side in blackbucks which is absent in sheep and goats (Fig. 3a, b and c).

To differentiate the species metrically, the measurements of the distal breadth and the distal thickness are used (Fig. 3d).

Radius and Ulna

1) The shaft is broad in blackbucks, slender in sheep and broader than blackbucks in the goats. 2) The lateral tuberosity is well developed in blackbucks and poorly developed in goats and it is absent in sheep. 3) In blackbucks, on the shaft near the proximal lateral articular

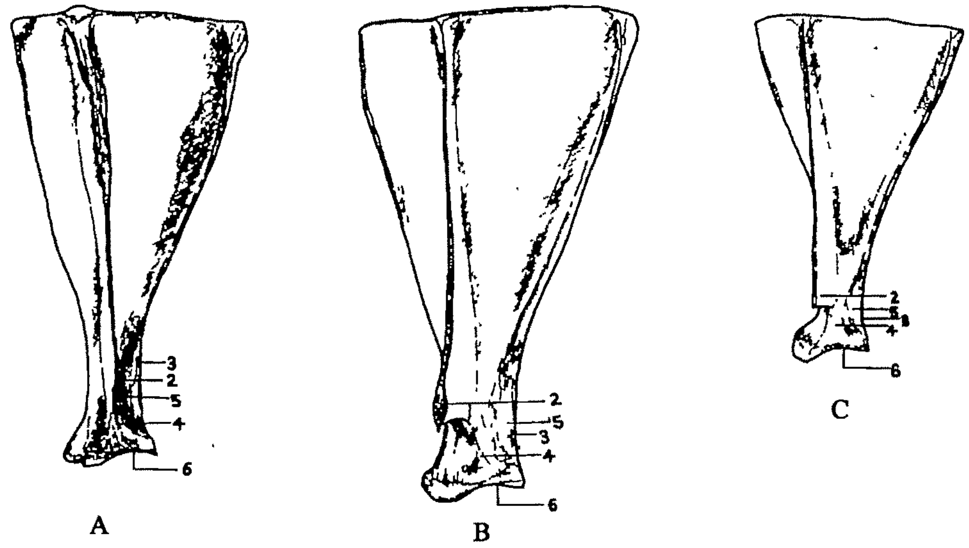

Fig. 2a: Scapula: Difference between A. *Antilope cervicapra*, B. *Capra hircus* and C. *Ovis aries*

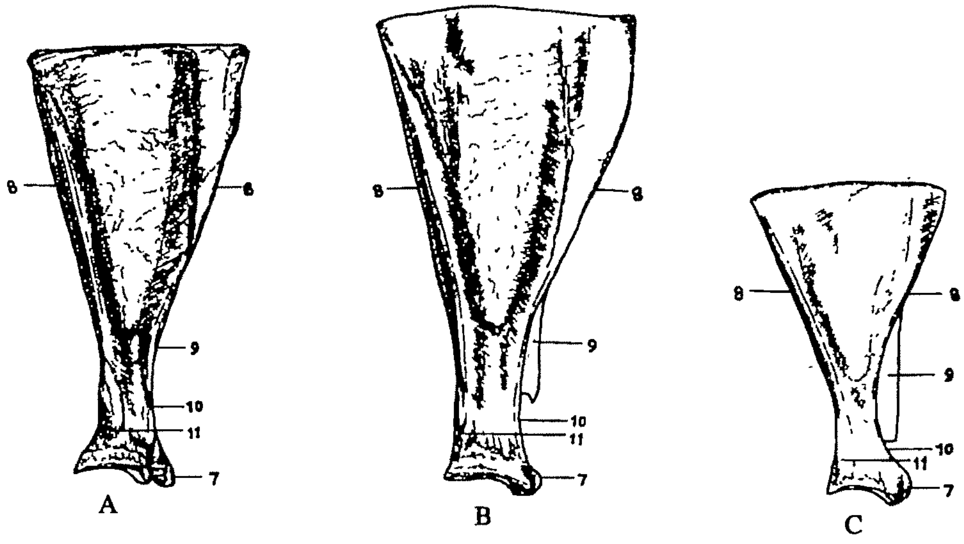

Fig. 2b: Scapula: Difference between A. *Antilope cervicapra*, B. *Capra hircus* and C. *Ovis aries*

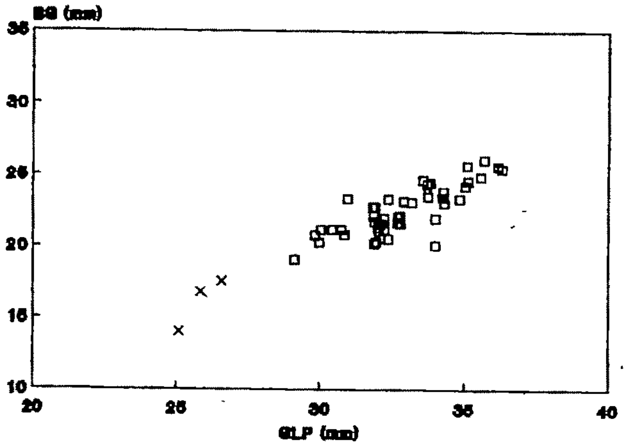

Fig. 2c: Species separation based on scapula measurements (GLP vs BG)

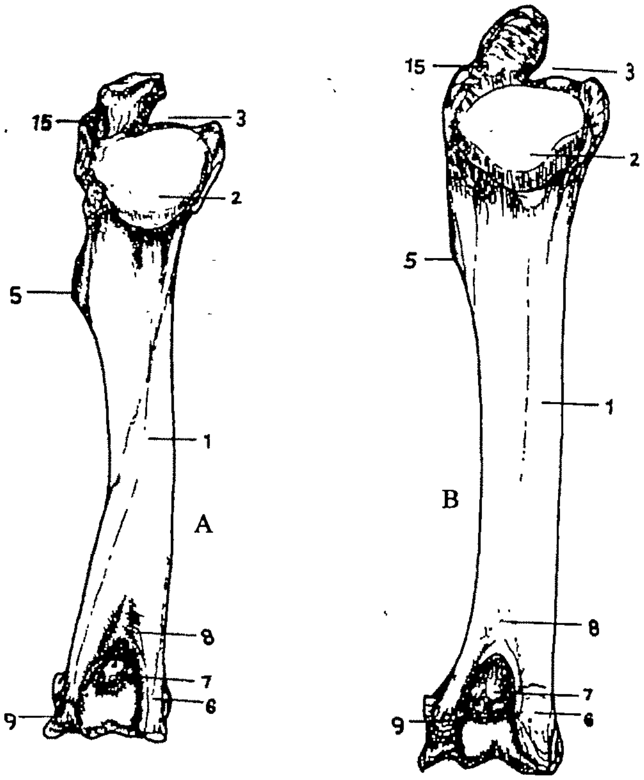

Fig. 3a: Humerus: Difference between A. *Antilope cervicapra* and B. *Capra hircus*

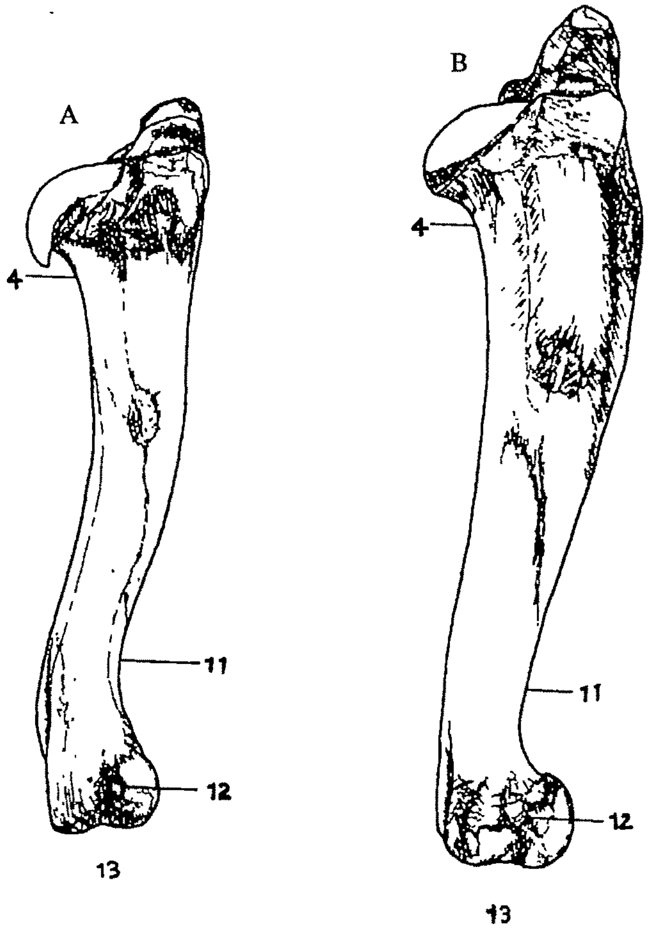

Fig. 3c: Humerus: Difference between A. *Antilope cervicapra* and B. *Capra hircus*

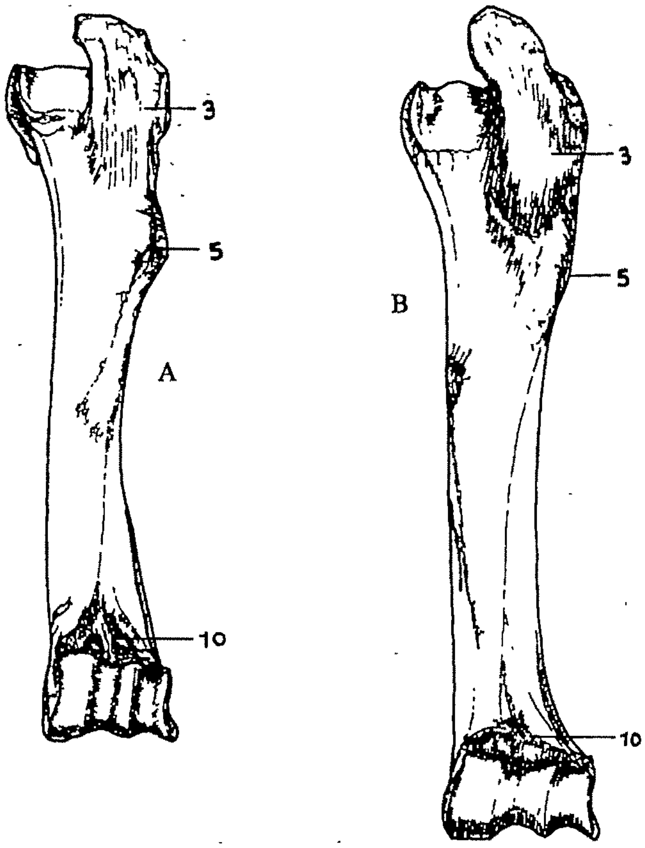

Fig. 3b: Humerus: Difference between A. *Antilope cervicapra* and B. *Capra hircus*

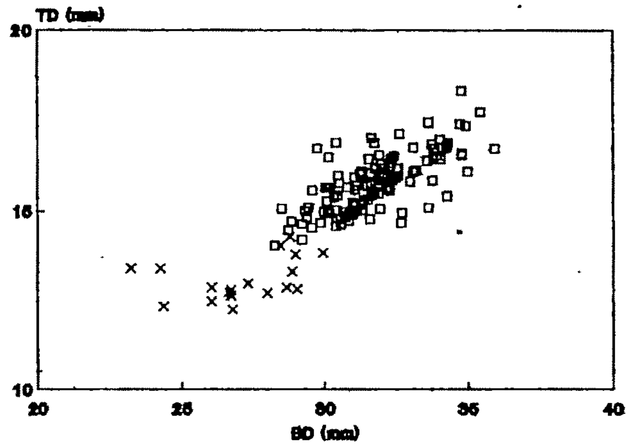

Fig. 3d: Species separation based on humerus measurements (BD vs TD)

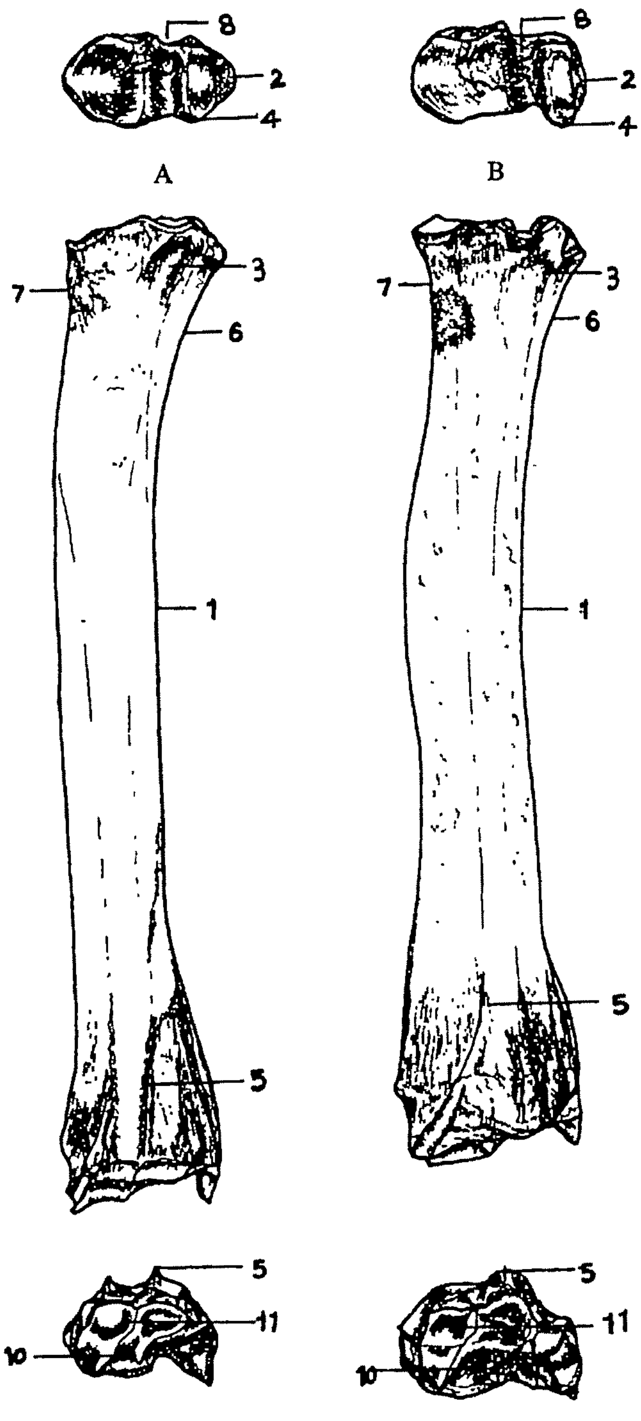

Fig. 4a: Radius: Difference between A. *Antilope cervicapra* and B. *Capra hircus*

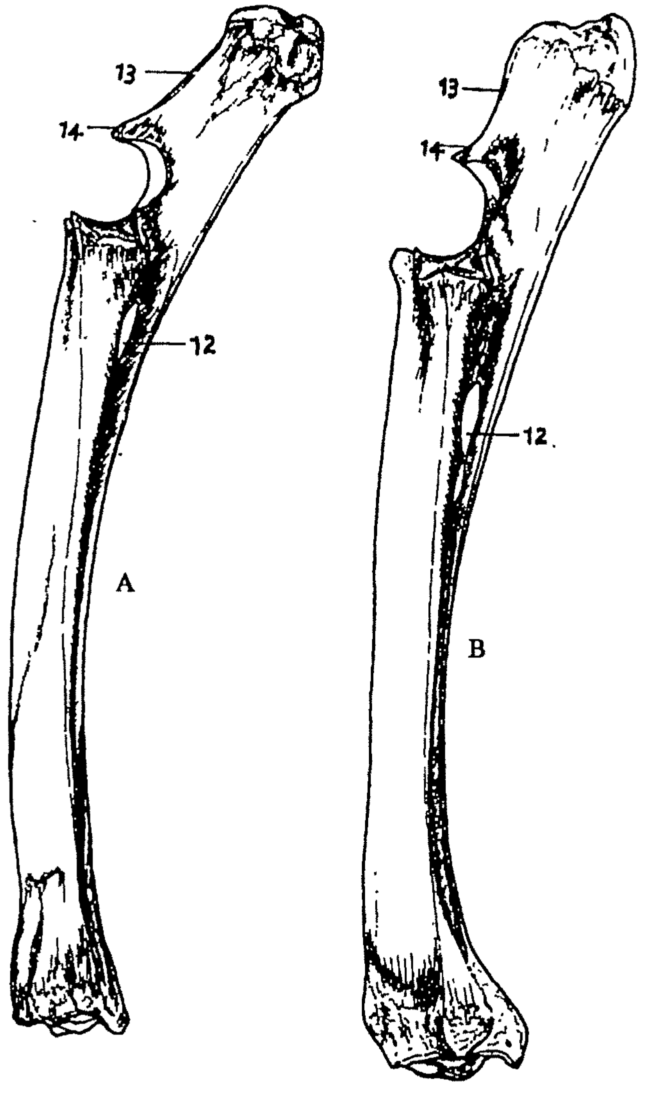

Fig. 4b: Radius and ulna: Difference between A. *Antilope cervicapra* and B. *Capra hircus*

facet, a small depression is visible which is absent in sheep and goats. 4) The lateral articular facet is projected upward in sheep and goats. It is very prominent in goats and absent in blackbucks. 5) Blackbucks have two very prominent ridges on the distal shaft, which is absent in sheep and goats. 6) The shaft is curved on the lateral side in blackbucks. In sheep it is slightly curved and in goats not curved. 7) The medial edge is straight proximally, with no lip formation in blackbucks. In sheep and goats the medial edge of the proximal articular surface has a distinct lip formation. 8) In blackbucks the ulnar notch is very small and shallow and is 'V' shaped. In sheep and goats the ulnar notch is deep and 'U' shaped. 9) Anteriorly and posteriorly the outline of the proximal articular surface is distinct in all three species. 10) The intermediate facet of the distal epiphysis terminates in the medial side of the shaft in blackbucks and in sheep and goats it ends towards the middle. 11) In blackbucks, the intermediate and medial facets are shallow and in sheep and goats the facets are deep.12) The interosseus space is very close to the proximal end in blackbucks and in sheep and goats it is away from the proximal end. 13) The bone is long from

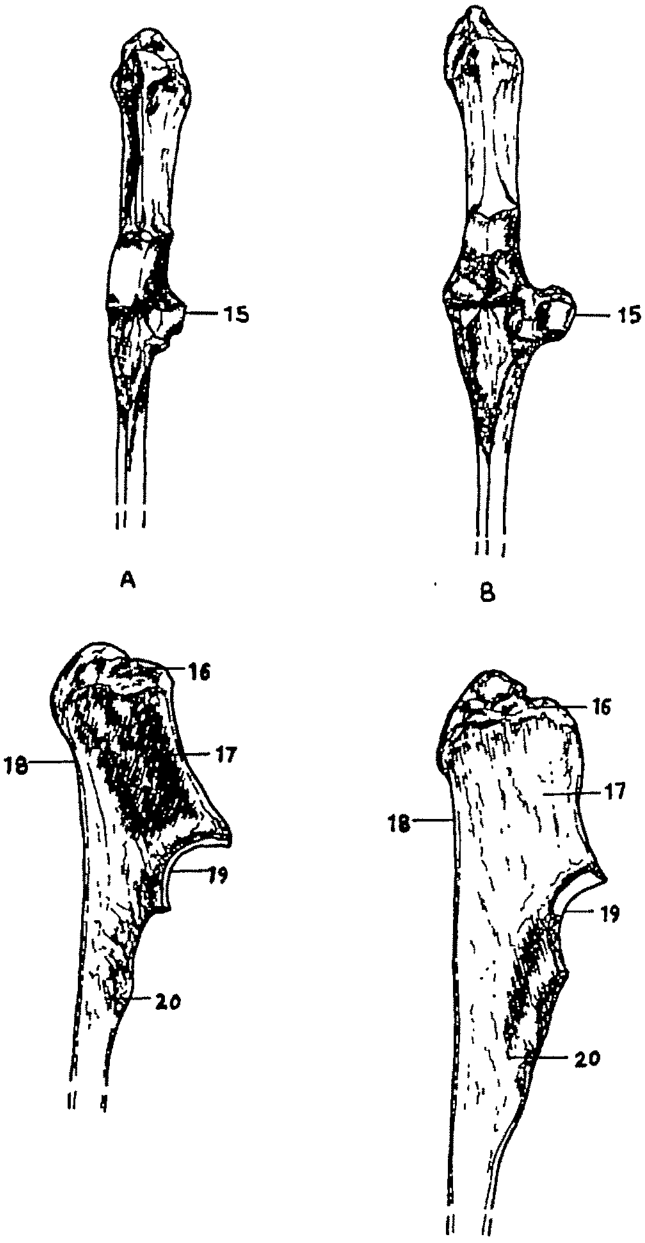

Fig. 4c: Ulna: Differences between A. *Antilope cervicapra* and B. *Capra hircus*

processus anconeus to olecranon in blackbucks and short in sheep and goats. 14) In blackbucks and sheep, the processus anconeus is projected and in goats it is depressed.15) The lateral facet is extended laterally and the medial facet is projected in sheep and goats and not in blackbucks. 16) In blackbucks the olecranon is slender and in sheep and goats it is broad and projected upward. 17) On the medial side, the olecranon has a depression in blackbucks, while in sheep and goats it is flat. 18) The dorsal ridge of the ulna is sharp in blackbucks and rounded in sheep and goats. 19) The shape of the semilunar notch is different in blackbucks than in sheep and goats (Fig. 4a, b and c).

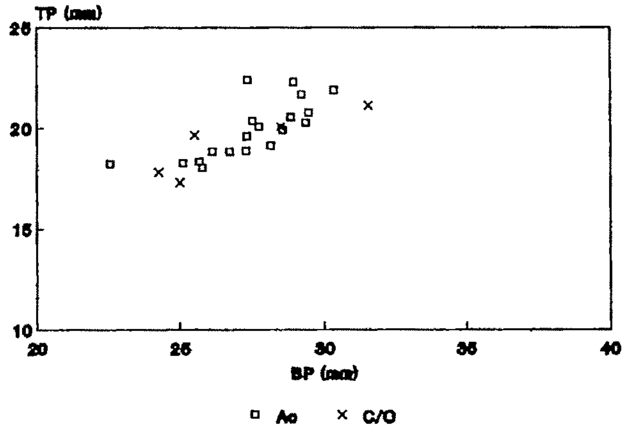

Fig. 4d: Species separation based on radius measurements (BP vs TP)

By using the measurements of proximal breadth and proximal thickness one can separate the blackbucks from the sheep/goats (Fig. 4d).

Metacarpal

1) Metacarpal is long and slender in blackbucks, short and slender in sheep and short and broad in goats. 2) On the anterior side of the shaft, the nutrient foramen is closer to the distal end and in sheep while in goats it is at a distance from the distal end. 3) The distal trochleas are straight and the sagittal ridge is sharp in blackbucks. In goats, both the trochleas are at an angle and in sheep, they are straight. 4) The distance between the distal trochleas and the shaft is short and the trochleas look very closely attached to the shaft in blackbucks. This distance is greater in sheep and goats and there is a small shallow pit between shaft and trochleas. 5) In blackbucks, the inter-trochlear face is parallel and the space between the two trochleas is less as compared to sheep and goats. 6) The lateral facet at the proximal end is more angled in sheep and goats than in blackbucks. 7) On the lateral side of the trochlea, the groove is deep in blackbucks and shallow in sheep and goats. 8) In blackbucks, on the posterior side of the shaft, the edges are sharp and a depression and muscle striation marks are noticed on the middle of the shaft. In sheep and goats, posteriorly the shaft is flat with no muscle striation (Fig. 5a).

With the help of measurements of the proximal breadth vs. proximal thickness and the distal breadth vs. distal thickness of metacarpal, blackbucks can be distinguished from sheep/goats (Fig. 5b and c).

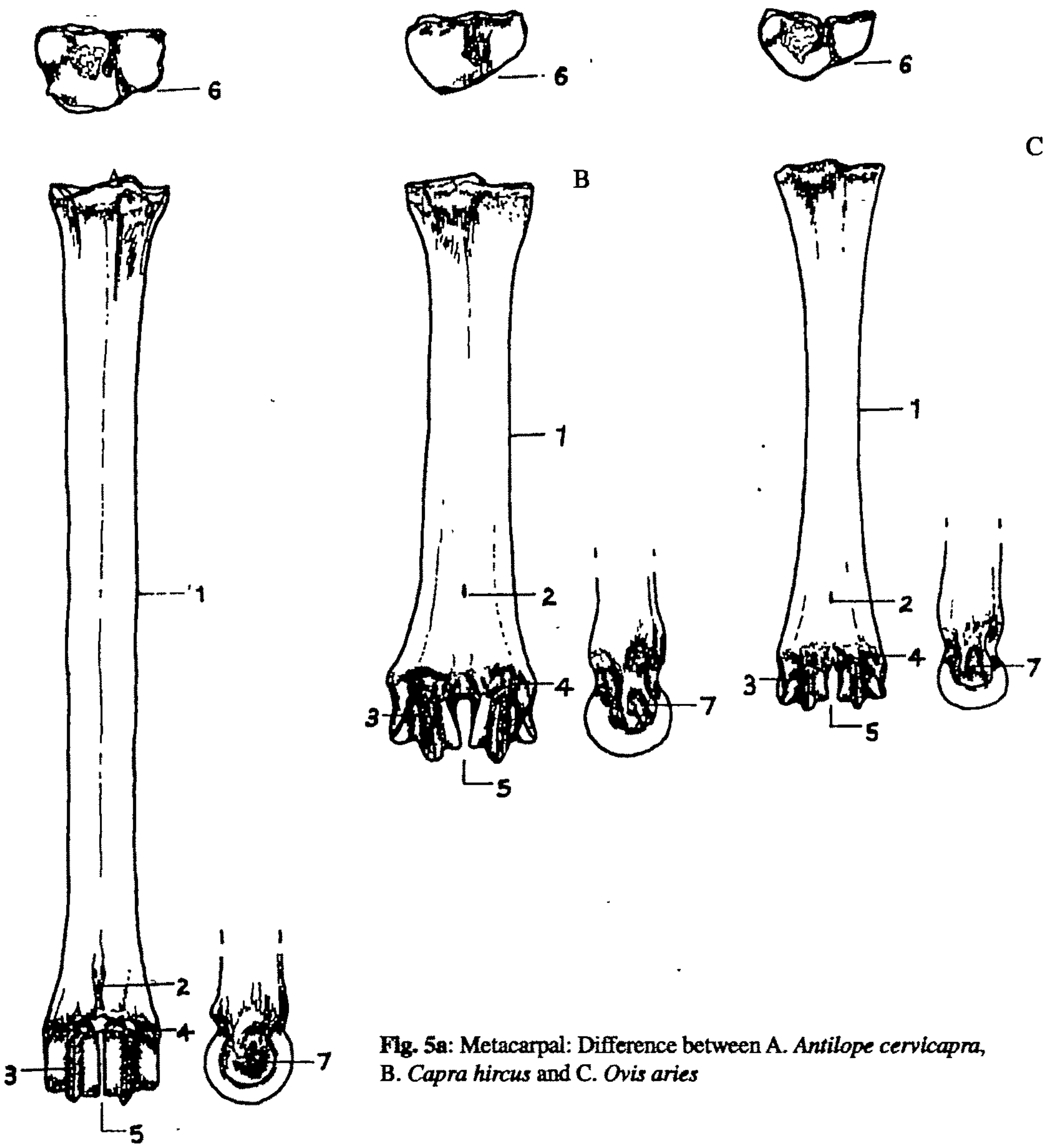

Fig. 5a: Metacarpal: Difference between A. *Antilope cervicapra*, B. *Capra hircus* and C. *Ovis aries*

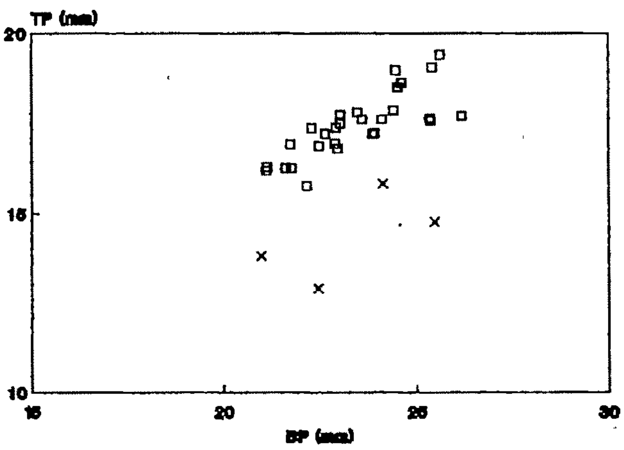

Fig. 5b: Species separation based on metacarpal measurements (BP vs TP)

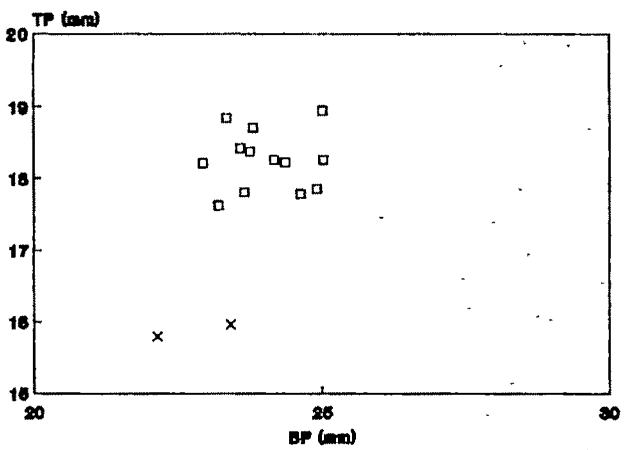

Fig. 5c: Species separation based on metacarpal measurements (BD vs TD)

Pelvis

1) In blackbucks the iliatic wing is broad and the medial and lateral sides of the ilium are curved. In sheep and goats the iliatic wings are neither broad nor the sides are curved. 2) The iliatic shaft is short in blackbucks and long in both sheep and goats. 3) In blackbucks, on the lateral side of the iliatic shaft, just above the acetabulum, a very prominent groove is observed. In goats, this groove is prominent on the medial side of the iliatic shaft, above the acetabulum and in sheep it is less developed. 4) In blackbucks the ischial spine is broader compared to sheep and goats and muscle striations are present. Muscle striations are absent in sheep and goats. 5) The pubis is rounded and prominent muscle striations are seen in blackbucks. In sheep, the pubis is round and without muscle striations and in goats the pubis is round only near the acetabulum which is otherwise flat and has muscle striations. 6) In blackbucks, the acetabulum is wide open and the distance between the facet of the pubis and the facet of the ischium is greater. In sheep and goats the acetabulum is not wide open. It is a bit closed and circular in shape and the distance between the two facets of pubis and ischium is comparatively shorter. 7) The obturator foramen is circular in shape in blackbucks and oblong in sheep and goats. 8) The lip of the acetabulum in the ischial region is thick and sloping down in blackbucks and in sheep and goats the lip is thin and projecting upwards. 9) The tuber ischii is well pronounced in blackbucks and less pronounced in sheep and goats. 10) In blackbucks, the ischium is short and broad and the lateral side is more curved. In sheep and goats the ischium is long and narrow and the lateral side is straight. 11) The pelvic symphysis is at a distance from the obturator foramen in blackbucks and further away in goats but in sheep it is closer. 12) The shape of ischium plate is different in all three species. 13) The ischium blade is angular in blackbucks and circular in sheep and goats (Fig. 6).

Femur

1) The femur head is perpendicular to the trochanter fossa in blackbucks, this portion is deep and in an angle of 45^{0}-60^{0} E. In goats, the head is almost in angle to trochanter fossa and in sheep this angle is wide. 2) The femur head is elongated in blackbucks and in sheep and goats it is

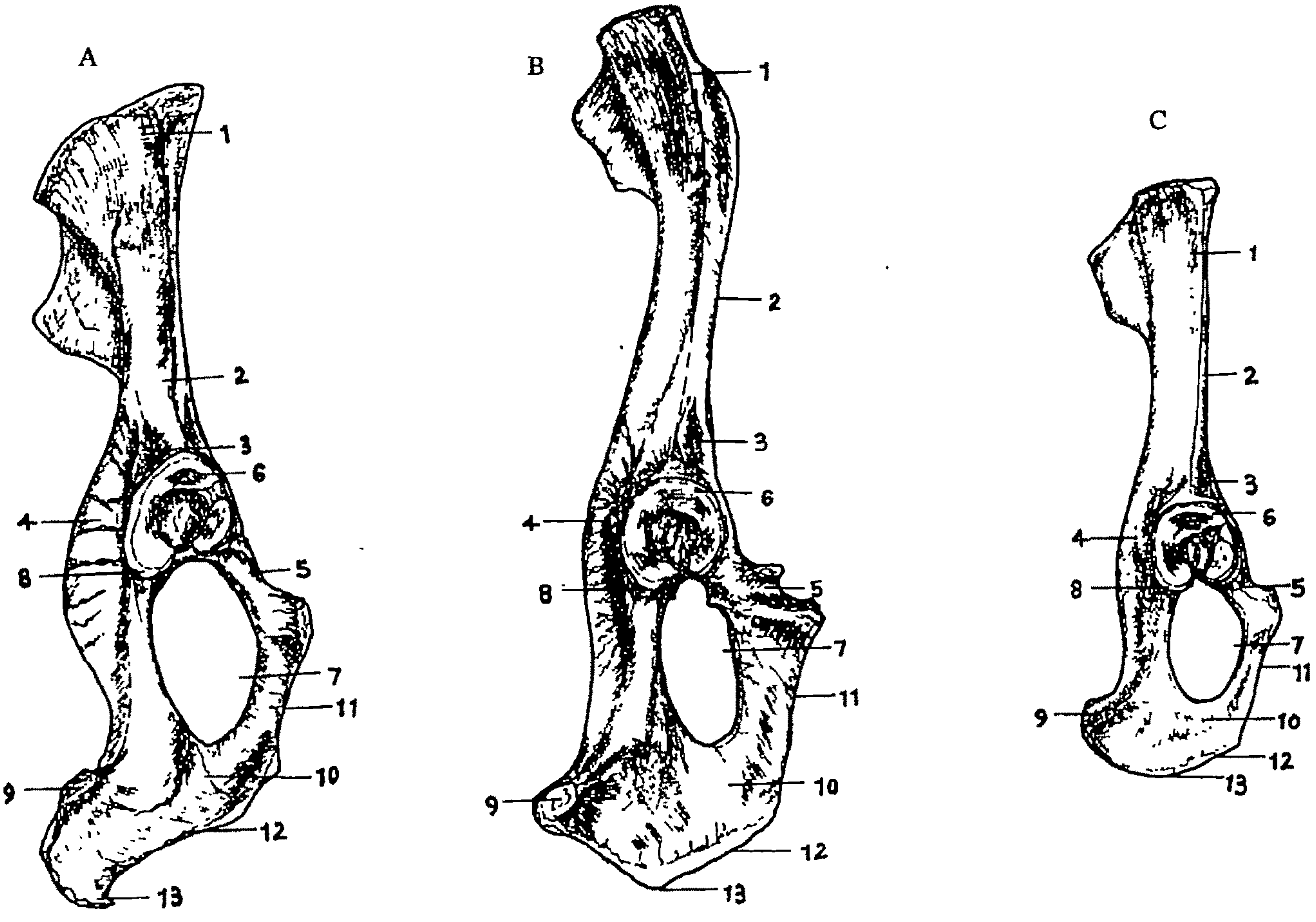

Fig. 6: Pelvis: Difference between A. *Antilope cervicapra*, B. *Capra hircus* and C. *Ovis aries*

rounded. 3) & 4) In blackbucks, the curvature of the neck region and of the trochanter major are greater than in sheep and goats. 5) At the distal end, the condyles are angled in blackbucks and are parallel in sheep and goats. 6) The trochanter minor is projected outwards and is very prominent in blackbucks and in sheep and goats it is less projected. 7) In blackbucks, the anterior side the proximal shaft is flat and in sheep goats it is bulbular. 8) The proximal end is broad in blackbucks but shorter in sheep and goats. 9) In blackbucks, the nutrient foramen is located on the middle of the shaft on the anterior side, whereas it is on the lateral side in sheep and goats. 10) The distance between the two epicondyles is greater in blackbucks than in sheep and goats. 11) The medial epicondyle is higher than the lateral epicondyle in blackbucks and in sheep and goats both the condyles are on the same level. 12) The medial epicondyle goes straight to the shaft and the lateral epicondyle turns towards the lateral side and slightly angled in blackbucks. In sheep and goats both the epicondyles are parallel and turn towards the lateral side (Fig. 7a and b).

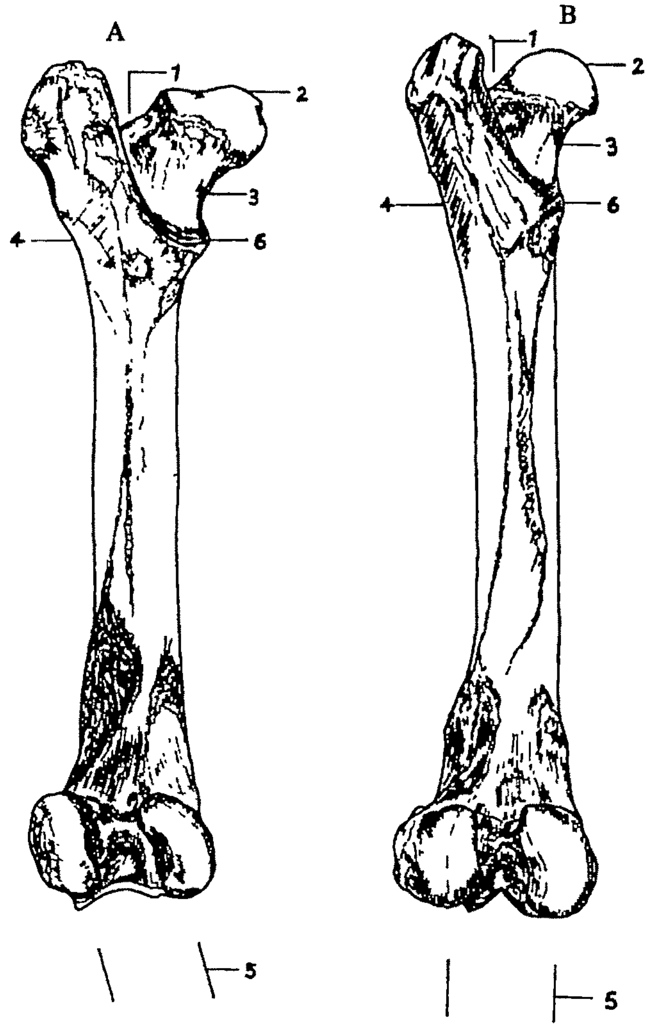

Fig. 7a: Femur: Difference between A. *Antilope Cervicapra* and B. *Capra hircus*

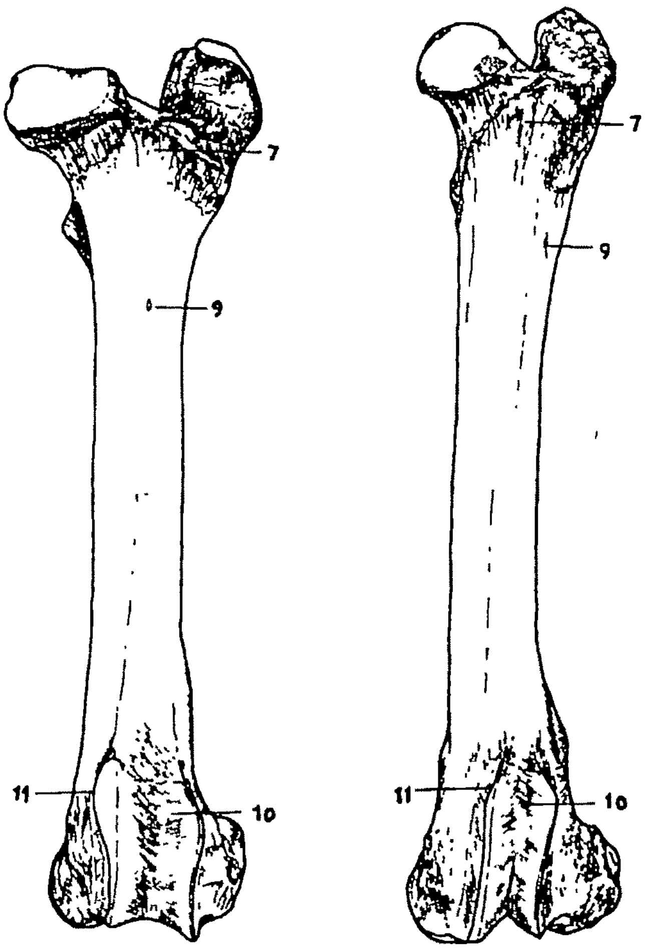

Fig. 7b: Femur: Difference between A. *Antilope cervicapra* and B. *Capra hircus*

By using the measurements of the proximal breadth and the proximal thickness, the separation of these species is possible (Fig. 7c).

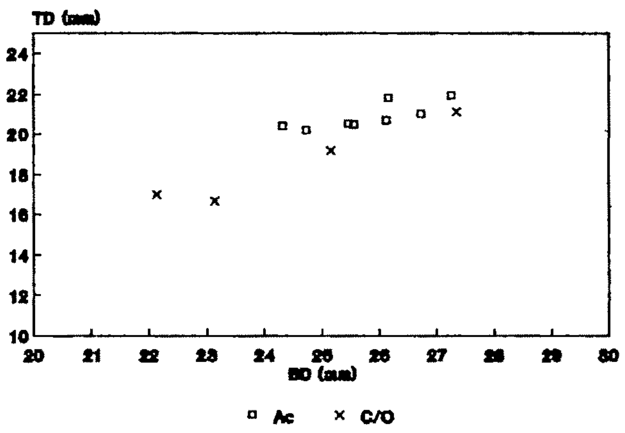

Fig. 7c: Species separation based on femur measurements (BP vs TP)

Tibia

1) At the proximal end, the tuberosity is long and narrow in blackbucks and broad and short in sheep and goats. 2) The lateral side curvature is lesser in blackbucks than in sheep and goats. 3) In blackbucks, the tibial crest has turned more to the lateral side and in sheep and goats it is only slightly curved to the lateral side. 4) On the anterior side, near the distal end, there is a small protuberance, which is parallel to the lateral ridge in blackbucks and is angled in sheep and goats. 5) Medially, on the distal end, the nutrient foramen is present in blackbucks and is absent in goats and present in sheep laterally. 6) The tuberosity between the lateral and medial articular grooves of the distal epiphysis marked in the figure is narrow in blackbucks and broad in sheep and goats. 7) On the proximal epiphysis the nutrient foramen is very deep in blackbucks and in goats it is shallow. In sheep there are many nutrient foramens, very small in size. 8) The groove between the tuberosity and the lateral articular facet is wide in blackbucks and in sheep and goats it is deep and 'U' shaped. 9) Proximal vestige fibula is bluntly pointed in sheep and goats whereas it is not prominent in blackbucks. 10) In blackbucks the space between the two articular facets is greater than in sheep and goats. 11) On the posterior side, the curve of the lateral articular facet is deep in blackbucks and shallow in sheep and goats. 12) In blackbucks the spine is very prominent but not in sheep and goats. 13) On the posterior side of the shaft, near the proximal part, muscle striations are very prominent in blackbucks and are not prominent in sheep and goats.

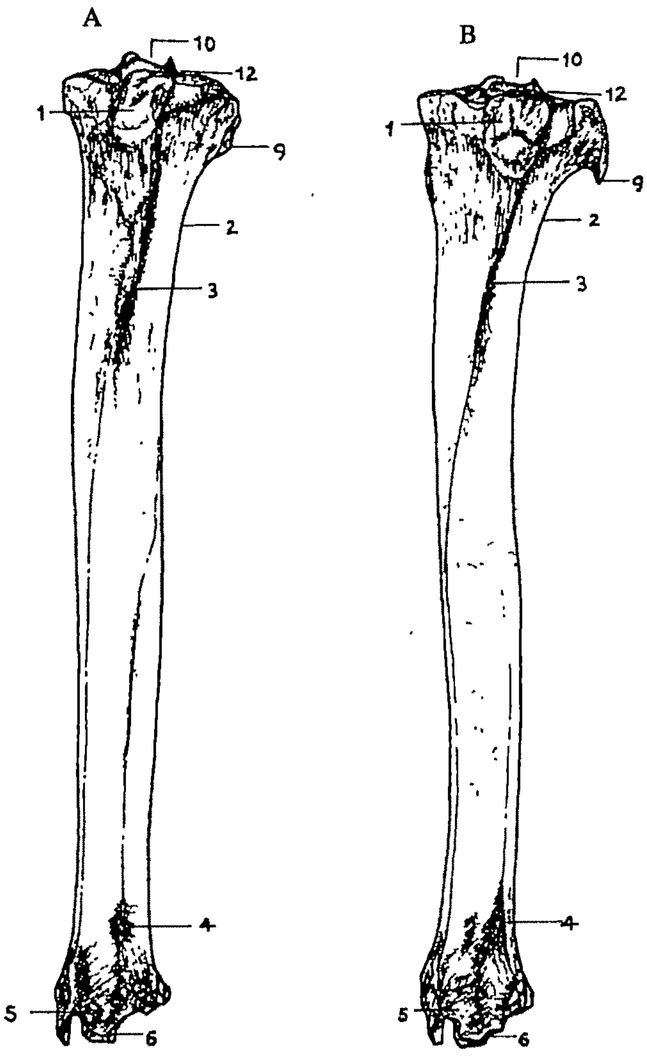

Fig. 8a: Tibia: Difference between A. *Antilope cervicapra* and B. *Capra hircus*

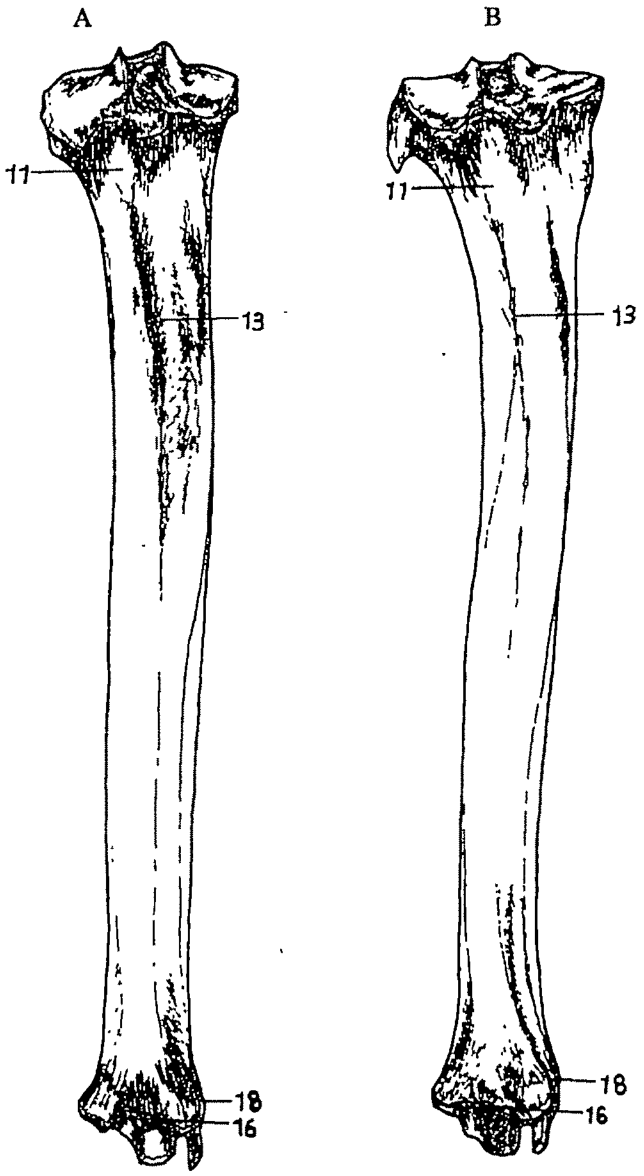

Fig. 8b: Tibia: Difference between A. *Antilope cervicapra* and B. *Capra hircus*

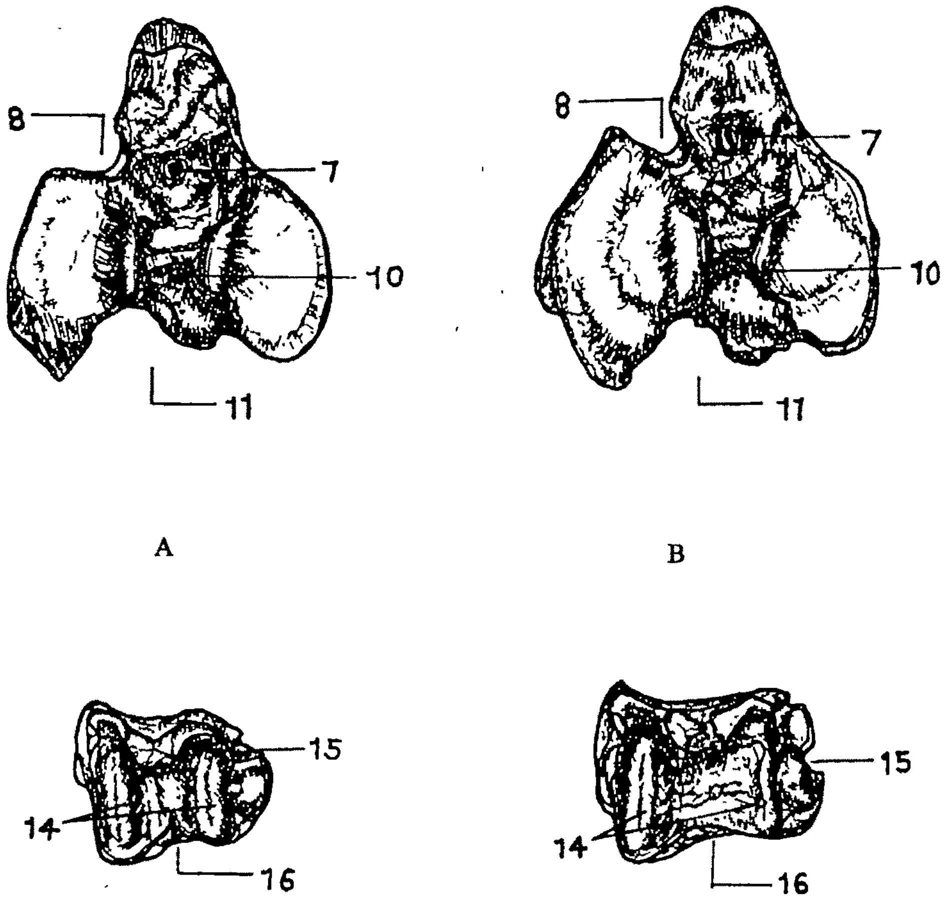

Fig. 8c: Tibia: Difference between A. *Antilope cervicapra* and B. *Capra hircus*

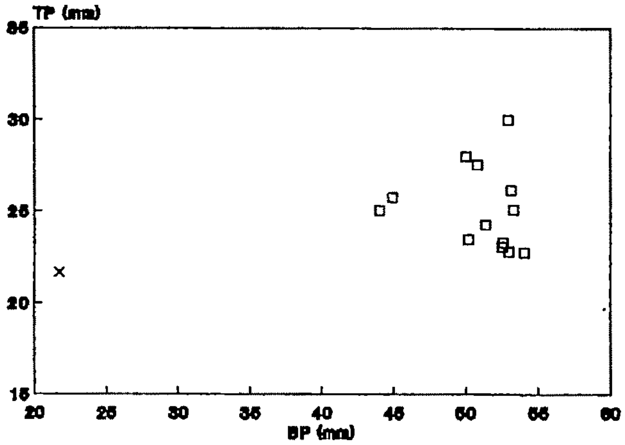

Fig. 8d: Species separation based on tibia measurements (BD vs TD)

14) In blackbucks the lateral and the medial grooves of the distal epiphysis are deep but shallow in sheep and goats. 15) The two small facets for the lateral malleolus are separated by a small groove, which is not very deep, and both the facets are smaller in size in blackbucks. This groove is deep but these facets are not separated by this groove and are a little bigger in size in sheep and goats. 16) The posterior edge of the distal articular surface has a very deep curve in blackbucks and in sheep and goats the curve is less prominent. 17) The distal epiphysis is broad and square in shape in sheep and goats and is not broad in blackbucks. 18) On the medial side, at the distal end, the groove is absent in blackbucks and is present prominently in sheep and goats (Fig. 8a, b and c).

These species could easily be separated out with the help of the measurements of the distal breadth and the distal thickness (Fig. 8d).

Metatarsal

1) The metatarsal is long and slender in blackbucks, short and slender in sheep and short and broad in goats. 2) The shaft is flat on the lateral and the medial side but not at the distal end in blackbucks. It is not so in sheep and goats. 3) On the posterior, the edges of the lateral and the medial sides of the shaft are sharp and form a groove on the middle of the shaft in blackbucks. In sheep and goats, posteriorly the shaft is flat. 4) In blackbucks the nutrient foramen is very small on the anterior distal part of the shaft but absent in the posterior side and it is also present on the

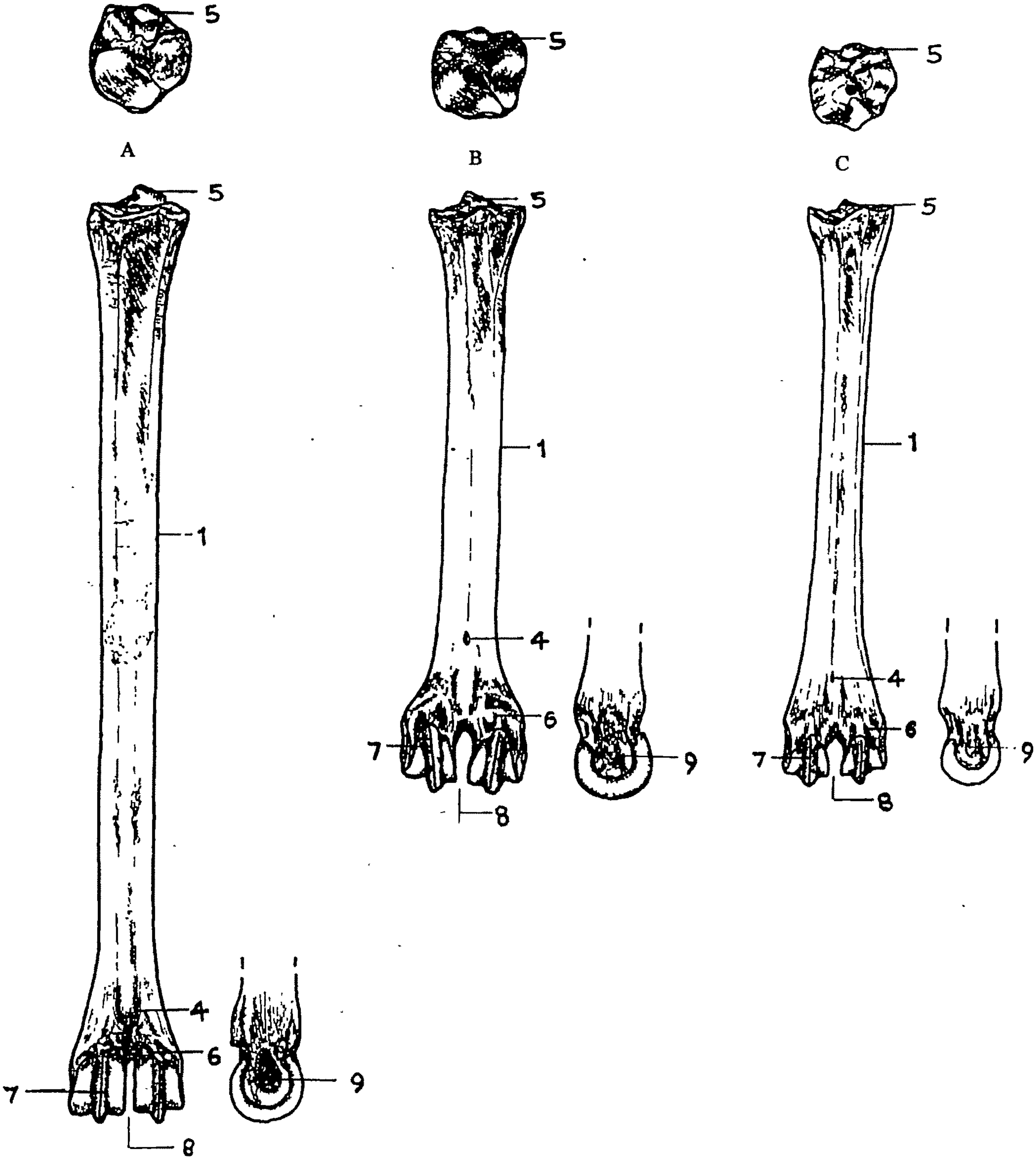

Fig. 9a: Metatarsal: Difference between A. *Antilope cervicapra*, B. *Capra hircus* and C. *Ovis aries*

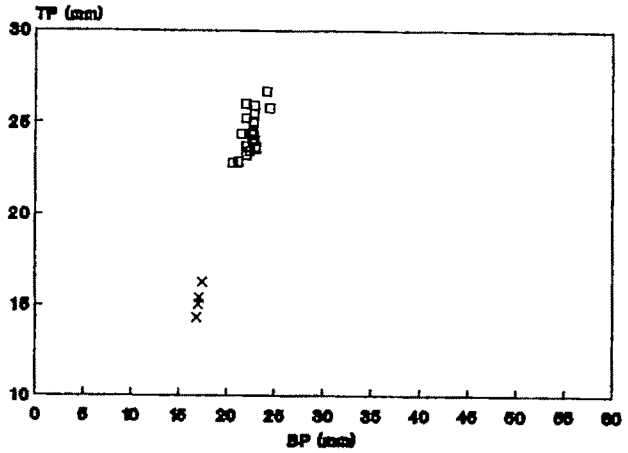

Fig. 9b: Species separation based on metatarsal measurements (BP vs TP)

posterior proximal part of the shaft but absent on anterior side. It is prominent on the distal part of the shaft on the anterior and posterior side in sheep and goats. The nutrient foramen is near to the distal end in blackbucks and in sheep and goats it is away from the distal end. 5) The facet is higher up and round in blackbucks and in sheep and goats it is lower and long. 6) The distance between the distal trochleas and the shaft is short. The trochleas look very closely attached to the shaft in blackbucks. This distance is greater in sheep and goats and there is a small shallow pit between shaft and trochleas. 7) The distal trochleas are straight and the saggital ridge is sharp in blackbucks. In goats, both the trochleas are at an angle and in sheep, they are straight. 8) In blackbucks the inter-trochlear faces are parallel and the space between the two trochleas is less as compared to sheep and goats. 9) On the lateral side of the trochlea, the groove is deep in blackbucks and shallow in sheep and goats (Fig. 9a).

Measurements of the proximal breadth and the proximal thickness are used to differentiate blackbucks, sheep and goats (Fig. 9b).

Astragalus

1) The anterior surface of the astragalus of blackbucks is round and bulbular and in sheep and goats it has a slight depression. 2) In blackbucks, the facet near the distal end on the anterio-medial side is poorly developed; it is well developed in sheep and goats. 3) Proximally, in between the lateral and medial sides, the depression is more deep in blackbucks and shallow in sheep and goats. 4) And distally the depression is deep in sheep and goats and shallow in blackbucks. 5) The proximal lateral condyle is blunt and rounded in blackbucks and pointed in sheep and goats. 6) The marked portion is shallow and closed in blackbucks and deep and opened in sheep and goats. 7) & 8) Posteriorly, in between the lateral and medial condyles, the groove is deep in blackbucks and shallow in sheep and goats. 9) At the posterior medial side, the marked portion in the figure is less projected in blackbucks and more projected in goats than in sheep. 10) On the posterior side, the distal medial condyle is angled in blackbucks and straight in sheep and goats. 11) On posterior part of the distal condyle the groove is shallow in blackbucks and deep in sheep and goats. 12) Facets on the lateral side are different in blackbucks than in sheep and goats. 13) The facet at the distal end is elongated in blackbucks and

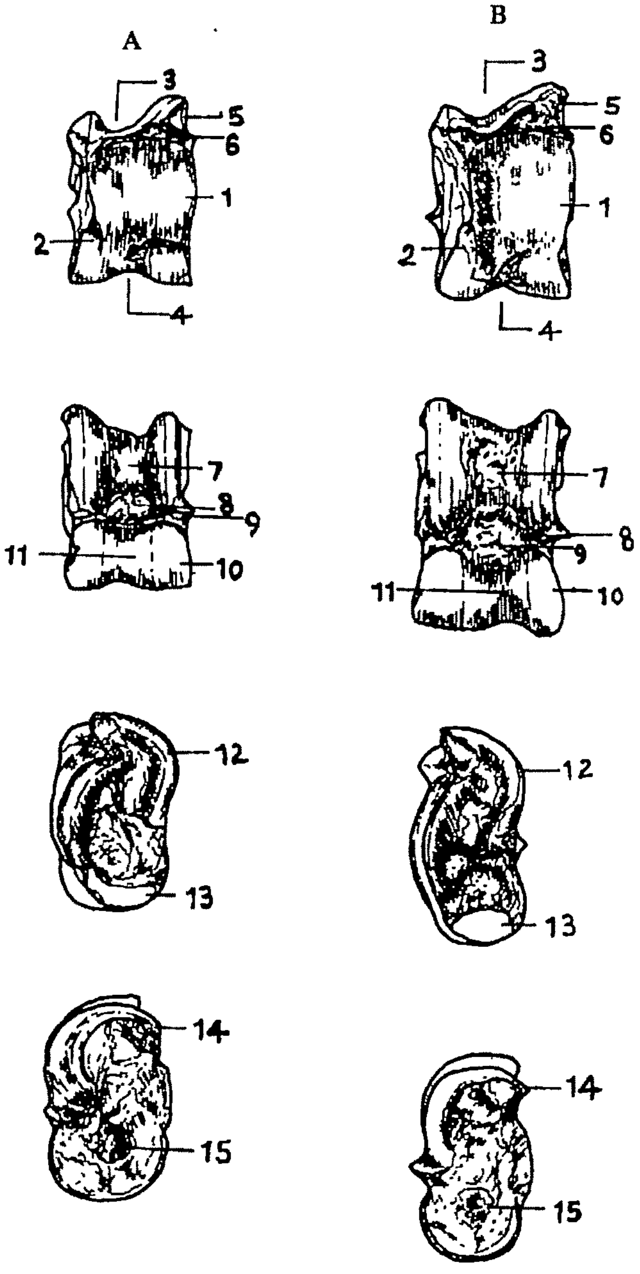

Fig. 10a: Astragalus: Difference between A. *Antilope cervicapra* and B. *Capra hircus*

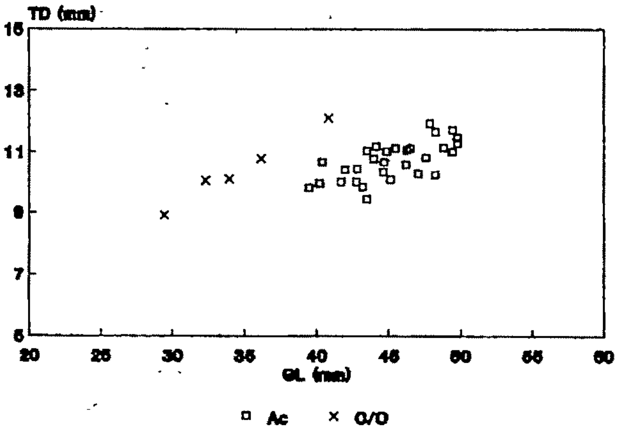

Fig. 10b: Species separation based on astragalus measurements (GLL vs TL)

rounded in sheep and goats. 14) On the anterior side, proximally, the edge of medial side is rounded in blackbucks and is projected out in sheep goats. 15) At the distal end of the medial side, the round facet is deep in blackbucks and shallow in sheep and goats (Fig. 10a).

Using the measurements of greatest length of lateral side and the thickness of the same (Fig. 10b) separates out blackbucks and sheep/goats.

Calcaneum

1) In blackbucks the corpus calcanei has a convexity and is straight in sheep and goats. 2) The tuber calcanei is pointed in blackbucks and in sheep and goats it is rounded. 3) In blackbucks the sustentaculum tali projects within the body and it projects outside the body in sheep and goats. 4) The medial protuberance is prominent and the shape is different in blackbucks than the sheep and goats. 5) The shape of the lateral articular facet for the centrotarsal is

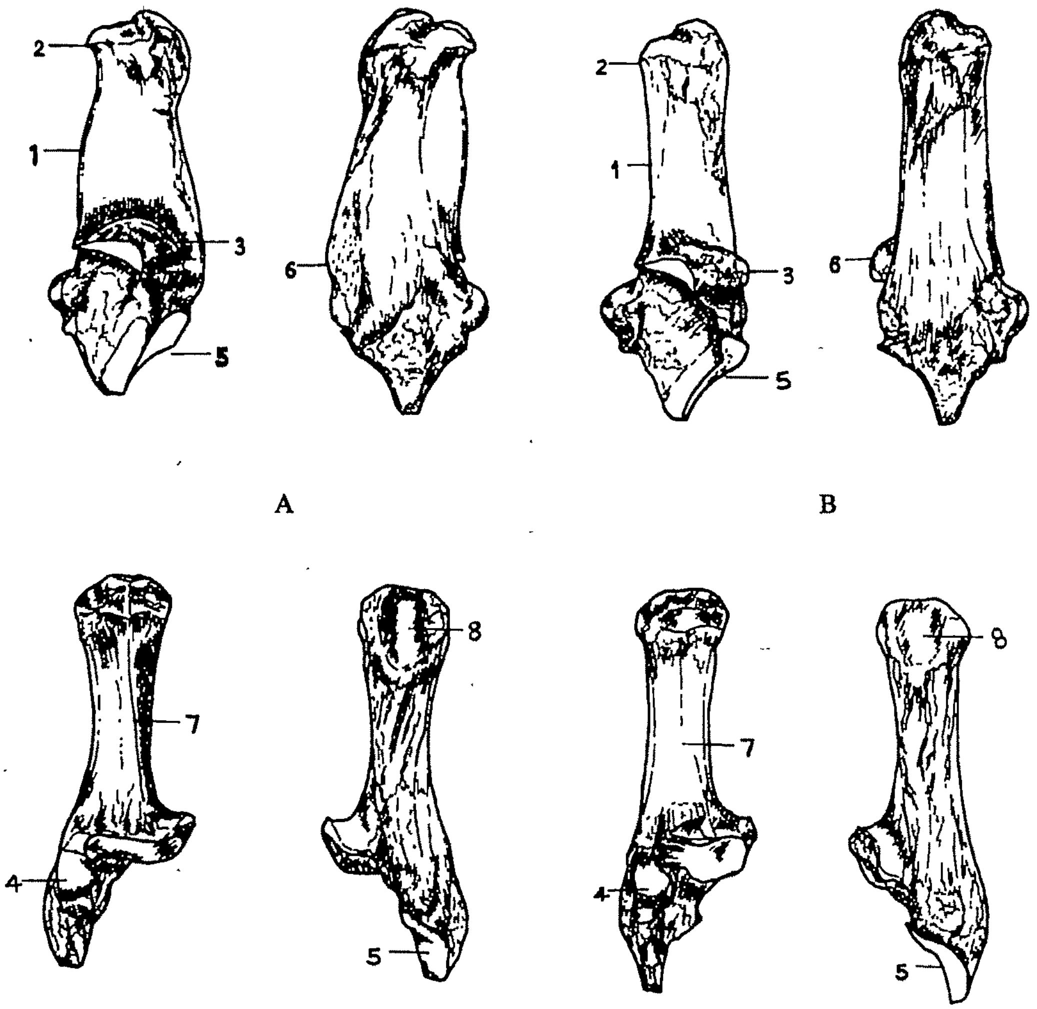

Fig. 11: Calcaneum: Difference between A. *Antilope cervicapra* and B. *Capra hircus*

less curved in blackbucks and is more curved in sheep and goats. 6) From the lateral side the sustentaculum tali is not visible in blackbucks but visible in sheep and goats. 7) On the anterior side of the corpus calcanei, a sharp ridge is formed in blackbucks and it is rounded with no ridge in sheep and goats. 8) On the distal side, the proximal tuberosity has a marked depression in blackbucks but shallow in sheep and goats (Fig. 11).

Centrotarsal

1) On the lateral side, the facet for the calcaneum goes straight up in blackbucks and in sheep and goats it is curved to the medial side. 2) The nutrient foramen is on the lateral articular facet in blackbucks and in sheep and goats it is in between the lateral articular facet and the facet for the calcaneum. 3) The distance between the facets for the calcaneum and the astragalus is more in blackbucks and less in sheep and goats. 4) On the dorsal side the shape of the medial articular facet is different. In blackbucks the lateral facet is higher up and semi-circular in shape and the medial facet is square in shape. In sheep and goats both the facets are elongated. 5) The groove in between the cranial and the caudal articular facets on the lateral side is shallow in blackbucks and in sheep and goats groove is deep (Fig. 12).

First Phalanx

1) The proximal articular facets are elongated and compressed on the lateral and medial sides and the medial articular facet is slightly projected anteriorly. In sheep and goats, it is more square in shape. 2) In blackbucks, the shaft is curved, slender and compressed from both sides and in sheep and goats the shaft is straight and flat on the cranial side and rounded on both sides. 3) The proximal articular facets are longer in blackbucks than in sheep and goats. 4) The groove on the lateral side of the distal end is shallow in blackbucks and deep in sheep and goats. 5) The lateral proximal articular facet is higher up in goats than in sheep and in blackbucks. 6) Medially, at the distal end, the small groove is very prominent and deep in blackbucks and is poorly developed in sheep and goats. 7) In blackbucks, on the cranial side, the groove between the lateral and medial articular facets is triangular in shape and in sheep and goats it is square in shape. 8) The distal articular facets are not flaring out and the groove between the facets is shallow in blackbucks and the facets are flaring in sheep and goats and the groove is deep. 9) On the posterior side, at the proximal end, the lateral and medial sides are closer in blackbucks and in sheep and goats there is deep 'U' shaped groove on the posterior side and also the lateral and medial sides are broader. 10) Distal epiphysis is slender in blackbucks and broad in sheep and goats.11) On the posterior side, the shaft is concave in blackbucks and flat in sheep and goats (Fig. 13a).

The measurements of the proximal breadth vs. thickness, greatest length vs. distal thickness and the distal breadth vs. thickness could easily be used for differentiating these species (Fig. 13b, c, d).

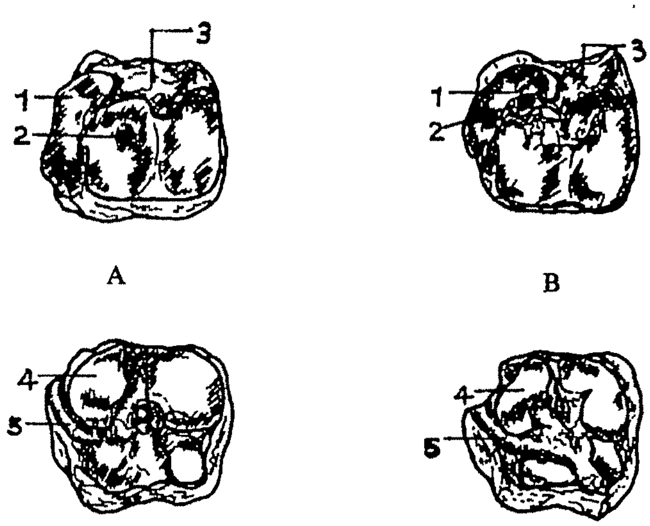

Fig. 12: Centrotarsal: Difference between A. *Antilope cervicapra* and B. *Capra hircus*

Second Phalanx

1) In blackbucks it is small in size and slender and in sheep and goats it is bigger in size, thick and broad. 2) The cranial side of the proximal end is projected upward in blackbucks and is flat in sheep and goats. 3) The distal lateral and medial articular facets are on the same plane in blackbucks and in sheep and goats the medial facet is projecting downwards. 4) In blackbucks the posterior line of the lateral side of the proximal epiphysis is curved and slightly below from the epiphysis there is a projection and in sheep and goats it is straight with no projection. 5) The groove between the lateral and the medial distal articular facets is deep and both the facets terminate posteriorly almost at the same level in blackbucks and in sheep and goats the groove is shallow and posteriorly the lateral facet is longer than the medial one. 6) The proximal articular surface is elongated and narrow in blackbucks. In sheep and goats the proximal articular facets are wider and short and the proximal epiphysis is square in shape. 7) On the medial side at the distal end groove is deep in blackbucks and shallow in sheep and goats (Fig. 14a).

The proximal breadth vs. thickness and the greatest length vs. distal breadth are the measurements used to separate out blackbucks and sheep/goats (Fig. 14b and c).

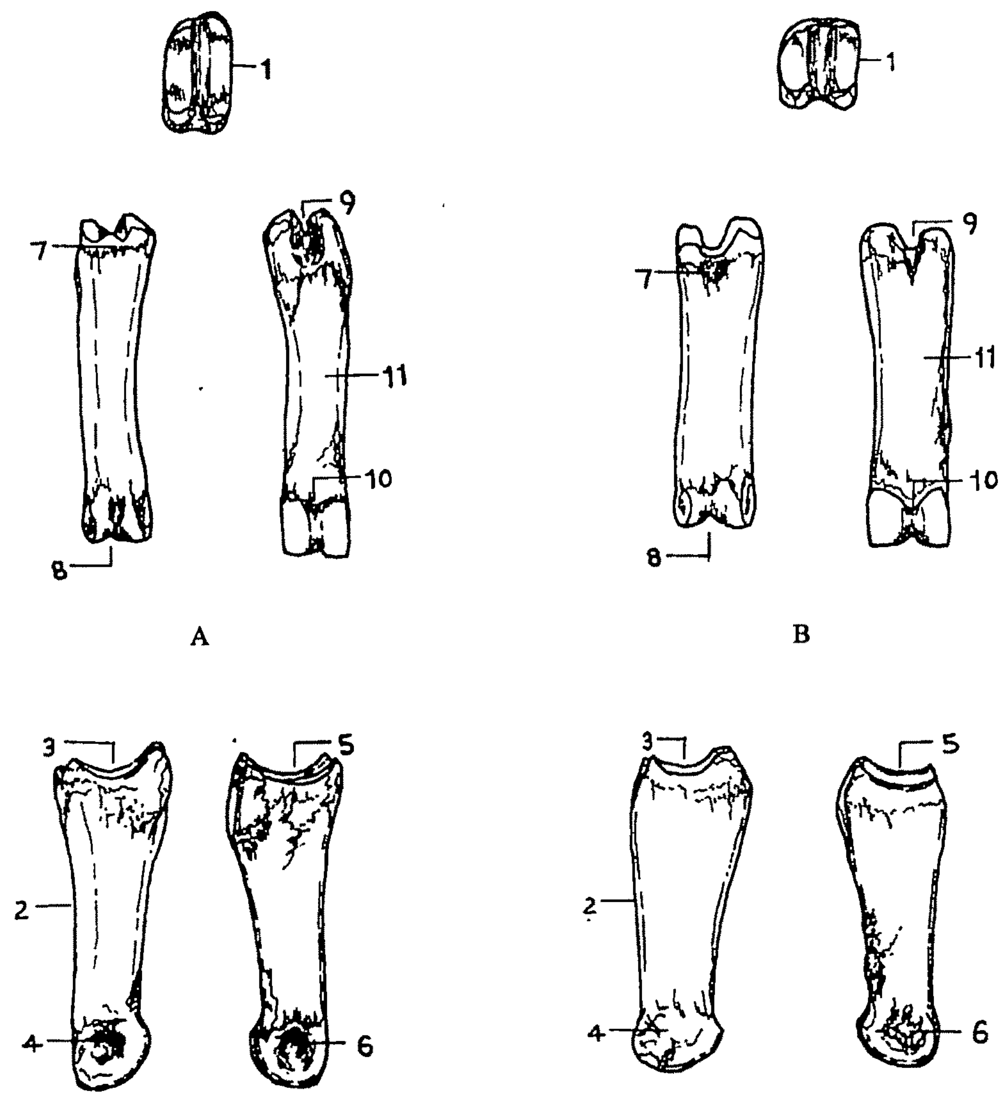

Fig. 13a: First Phalanx: Difference between A. *Antilope cervicapra* and B. *Capra hircus*

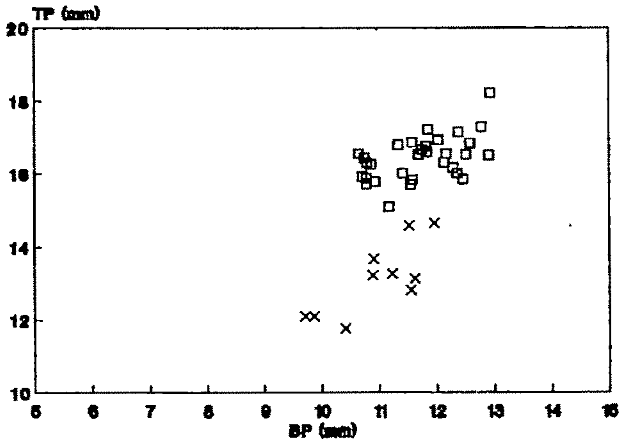

Fig. 13b: Species separation based on first phalanx measurements (BP vs TP)

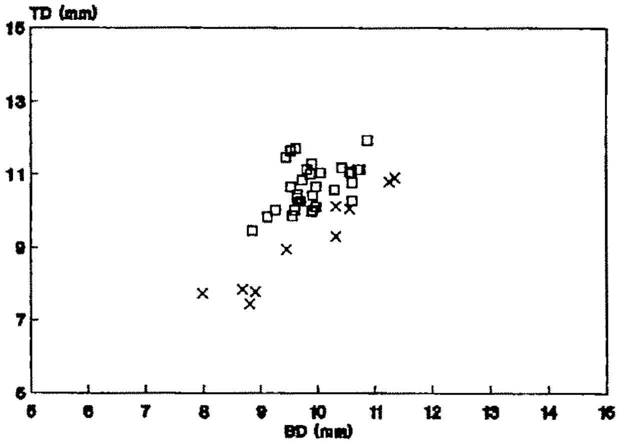

Fig. 13c: Species separation based on first phalanx measurements (GL vs TD)

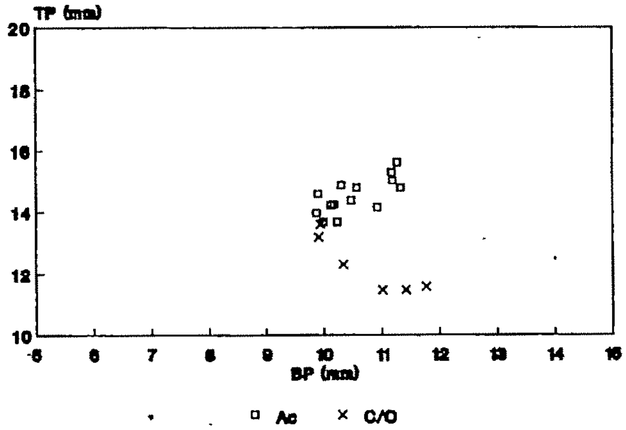

Fig. 13d: Species separation based on first phalanx measurements (BD vs TD)

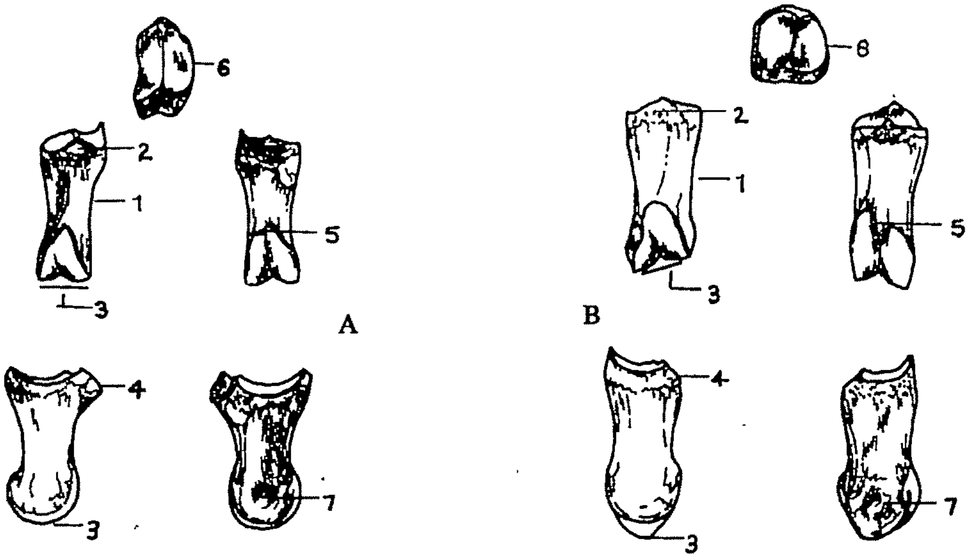

Fig. 14a: Second Phalanx: Difference between A. *Antilope cervicapra* and B. *Capra hircus*

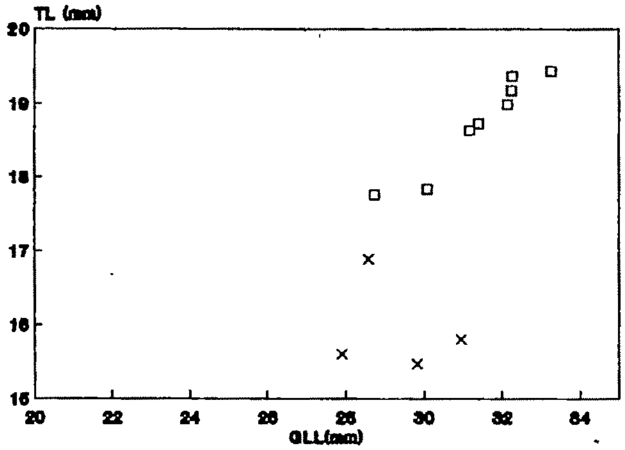

Fig. 14b: Species separation based on second phalanx measurements (BP vs TP)

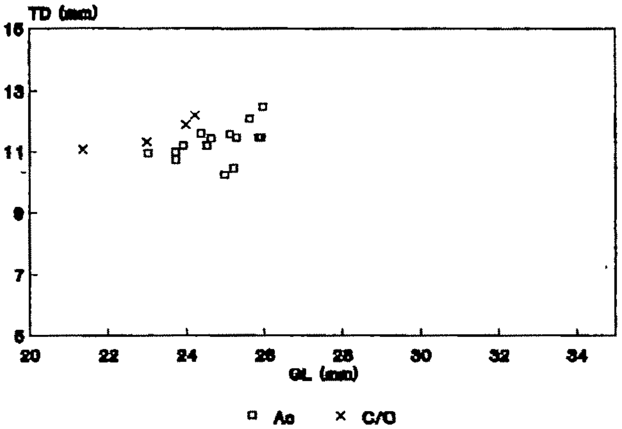

Fig. 14c: Species separation based on second phalanx measurements (GL vs TD)

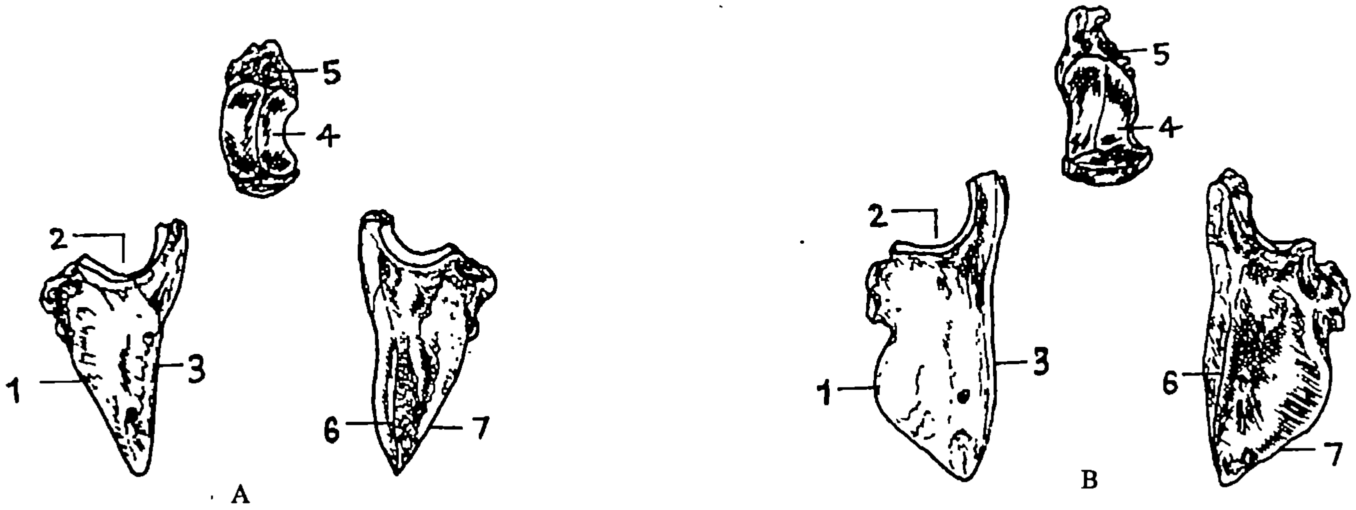

Fig. 15: Third Phalanx: Difference between A. *Antilope cervicapra* and B. *Capra hircus*

Third Phalanx

1) Overall the shape is triangular in blackbucks and semicircular in sheep and goats. 2) The proximal articular surface is semicircular in shape and deep in blackbucks and in sheep and goats it is right angled. 3) The posterior outline is straight in blackbucks and curved in sheep and goats. 4) Both the articular facets are parallel in blackbucks and not parallel in sheep and goats. 5) In blackbucks, on the cranial side of the proximal articular surface, there are two nutrient foramens and only one is present in sheep and goats. 6) A ridge is present on the medial side and it starts from the middle of the body in blackbucks and in sheep and goats it is at the base. 7) The anterior side is thick in blackbucks and thin in sheep and goats (Fig. 15).

Acknowledgement

We are thankful to Y. Matsushima for drawing the bones.

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Book Reviews

Introduction to Geomorphology. V.S. Kale and Avijit Gupta 2001. Calcutta: Orient Longman Limited. Pages 274, Price Rs. 190.

This book is a welcome textbook on a subject of importance to a large range of scientists, including geologists, geographers, environmentalists and even archaeologists. Many readers of this Journal are working in interdisciplinary areas, where new subjects have to be mastered. This textbook has been written to introduce the basic concepts of geomorphology to MA level students in the Indian university setting. It therefore will be useful for scientists with non-Earth Science background who need to understand the basic concepts of geomorphology. A significant feature of the book is illustrations and examples of various landforms from Asian regions, particularly from the Indian subcontinent. Since the book is written for Indian students, the text is easy to follow, uncluttered by jargon. The illustrations are self-explanatory and of high quality.

The main text, comprising 266 pages, is divided into fourteen chapters. A unique feature of the book is the chapters on *Sediments in Section* and *Natural Hazards and Environmental Management*. Methods of observing sediments, properties, models of deposition and different dating techniques. All this information will be extremely useful to students, especially those working on field oriented problems. Environmental problems related mainly to dam construction are discussed. Though many of the environmental problems are related to landscape degradation, geomorphologists play a limited role in solving them. According to the authors, this chapter is designed to introduce readers to the utility of geomorphology in environmental studies. River basin and processes of erosion and channel forms are discussed in detail.

The cover photo of a sea arch, eight colour plates, and the general layout of the book are good. Since the book is written as a textbook for students, a set of probing questions given at the end of each chapter will facilitate understanding of the subject. Adequate references given at the end of each chapter will help the students.

The book is a good addition to the library of Earth Sciences.

Savita Ghate
Dr. Ambedkar College of
Arts and Commerce,
Jaijawan Nagar, Yerawada
Pune 411 006

Awadh aur Ayodhya – Puratattvik Drishti. Vijay Prakash Varma. 2000. Allahabad: Swabha Prakashan. Pages 96, Price Rs. 100.

To some people the 'past' denotes the bygone era of great achievements and to some a chronicle of exploitation of the subaltern communities. Some people may look at the past as the story of human groups always fighting for social and political supremacy. This has been the case of Ayodhya's past. So much has been written on it and the issues debated vigorously at several levels in the last decade that looking at ancient Ayodhya has now become an extremely tricky task. J.N. Pal tells us in the preface that Vijay Prakash Varma conducted his doctoral research when Ayodhya was caught in the crossfire of conflicting political ideologies, and people were going through a phase of turmoil and agony. Against this background, it is delightful to find that the author has come out with a book in Hindi dealing with the cultural history of the Faizabad region. Ayodhya was a prominent city of ancient Kosala Mahajanapada during the historic period. But the book deals with it in the context of the region-level archaeological record.

The book is divided into seven chapters. The first chapter introduces us to the general physical features, rainfall, water bodies, tribes, flora and fauna of Faizabad District. In the second chapter the author reviews the evidence of human occupation in the middle Ganga Valley from Upper Palaeolithic to Chalcolithic culture. This sets a background for the third chapter in which the history of Kosala Mahajanapada is discussed in detail using traditional textual historical sources. In this chapter the author has summarised historical events associated with Faizabad District during the Gupta, post-Gupta and medieval periods. It ends with a short account of the annexation of Awadh by the East India Company during the time of Wajid Ali Shah in 1856. The fourth chapter gives a list of places of archaeological importance and brief description of the cultural remains. The fifth chapter is important to the understanding of archaeological setting of Ayodhya and it provides a summary of archeological explorations and excavations conducted here. The survey of few mounds done in 1961-62 by V.S. Dubey pointed to rich cultural heritage. Study done by archaeologists from the B.H.U. (1969-70) brought to light evidence of three phases of occupation. The author further discusses the evidence gathered during successive explorations and excavations, particularly the work done under the 'Archaeology of

Ramayana Sites Project'. Radiocarbon dates obtained from various deposits at Ayodhya show that the earliest habitation took place not before the seventh century B.C. The sixth chapter presents a picture of historical Ayodhya by integrating textual and archaeological evidence. The author emphasises that the story of the Ramayana has a conspicuous place in the folk culture of northern India, yet its historicity and archaeological identity are enigmatic. Though local tradition directs to remote past, settlement in this part of the Ganga Valley does no go earlier than the first half of the first millennium B.C.

As mentioned initially, it is not easy to alienate academic research work from the extra-academic interests. However, the author has successfully presented a picture of Ayodhya in an objective framework, and therefore it has surely augmented our understanding of the Ganga Valley during the past few millennia.

P.P.Joglekar
Department of Archaeology
Deccan College
Pune 411 006

***Historical Archaeology of India*. M.K. Dhavalikar, 1999. New Delhi: Books and Books. Pages. 274, Price Rs. 1015.**

The Indian sub-continent has been an area for archaeological research for over two hundred years. Since Independence, the pace of research has increased manifold, and despite some major lacunae we have reached a stage of knowledge when it is possible to offer a connected account of the prehistoric, protohistoric and historic India on the basis of archaeology. Although historical archaeology received due attention right from the time of Alexander Cunningham to Sir John Marshall, a cursory glance at the history of archaeological research in India shows a shift in attention to protohistoric period from Sir Mortimer Wheeler onwards. In due course, prehistoric archaeology also received adequate feedback from scholars. As a result, historic archaeology, despite the existence of written records, has remained in shadow till today.

In most of the excavations of multi-culture sites, historic levels get step-motherly treatment. There is a growing feeling that historic period, though equally important, has not received the recognition it deserves by the archaeologists and historians and, therefore, the problems related to it have not been resolved satisfactorily. The lack of systematic archaeological and literary data has resulted in a pathetic absence of literature on the subject. Except for a couple of studies, we do not have a succinct account of our historical archaeology explaining man-land interaction in different parts of the subcontinent.

The author himself has expressed this feeling in his preface that he was handicapped on account of non-availability of coherent literature while lecturing on historical archaeology to post-graduate classes. He has rightly pointed out that in many of our universities there is a separate course in historical archaeology under which only important excavations such as Taxila, Hastinapura and Kausambi are covered but there is no in-depth study of the entire span of the historic period with which I find difficult to disagree. Therefore, the aim of the present book is to provide a comprehensive picture of historical archaeology in the Indian context keeping in mind the shortcomings of the available data on the subject.

The book is divided into seven chapters besides relevant bibliography and index. Graphic illustrations in the form of maps and figures justify their context and add to the value of the book.

Chapter 1 is a background for introducing the main theme of the book. It deals with one of the crucial phases of the Indian culture i.e., Early Iron Age. Here, the author has given a critical review of the situation prevailing prior to the 6th century B.C., highlighting the associated cultures of Black-and-Red ware and Painted Grey Ware and has argued convincingly for evidence at the threshold of the second urbanization. While discussing tradition and archaeology, the crux of the author's argument is that our ancient literature has some historical sub-stratum and, therefore, it cannot be discarded lightly. At the end of the chapter, the author, on the basis of circumstantial evidence, has equated the Late Harappan with the Rigvedic Aryans expressing his view on one of the most debated issues in Harappan archaeology.

Chapter 2 deals with the cultural sequence. It begins with a brief resume of the history of archaeology with specific reference to excavations highlighting the turning points in the development of field archaeology. However, the major portion of the chapter is devoted to bringing out the personality of individual states by focussing on the cultural sequence. To attain this by gathering required authentic and scattered information is a Herculean task in the present scenario of our archaeological data. It appears obvious that the author has consulted all the relevant published literature and has had the benefit of personal contact with many researchers. On the whole, this chapter assesses the historical potentiality of our modern states. It seems by oversight the plan and elevation shown in Fig. 2.2 on page 24 of have been wrongly captioned as Sanghol – plan of the stupa instead of Sanchi Stupa No. 1.

Chapter 3 is devoted to urban growth. It is a critical review of various diagnostic parameters responsible for the process of second urbanization. Here the author has categorically stressed certain factors like population growth, centralization of surplus, monumental architecture, ruling class, writing, art, trade and coinage as decisive criteria which contributed by and large to the development of urbanization during the mid-first millennium B.C. It is a logical synthesis of archaeological and literary data available on the subject. It also provides a critical summary of previous contributions along with author's judgment on the issue.

Urban decline is the theme of chapter 4. In fact, not much of forethought has gone into the research while addressing the factors that led to the de-urbanization in the political and consequently cultural set-up of dynastic regimes in various regions of India from 4th to 10h century A. D. This period witnessed the downfall of the early prosperous empires and consequent decline and degeneration, which Dhavalikar calls as a period of stress and strain. Though various explanations have been offered to account for this decline, adverse climatic condition is considered to be the main factor. The author has cited several examples to justify his view. He further claims that this phenomenon was not peculiar to India alone but occurred over a large part of the Old World. This is supported by the records of floods in the Nile in Egypt and references available in our contemporary literature. It is a well-argued hypothesis and sounds logical. Aspects related to third urbanization and medieval archaeology are also discussed giving specific reference to medieval cities like Lalkot, Vijayanagara (Hampi) and Champaner. However, it is surprising that Fatehpur Sikri, where excavations were conducted more or less simultaneously along with Vijayanagara and Champaner as a national project, has escaped his attention.

The focus of discussion in Chapter 5 is the main ceramic types of the period under review. The author has given exhaustive details of Painted Grey Ware, Back-and-Red Ware, Northern Black Polished Ware, Red Polished Ware, Rouletted Ware, Russet Coated Ware, Arretine Ware, Megarian Ware and amphorae of Roman origin besides Muslim Glazed Ware and Chinese pottery including Celadon and Porcelain. It deals with important issues like distribution, technology, chronology and in some cases even the origin and authorship. Some of this presents a perspective different from the conventional ones.

Chapter 6 focusses on cultural materialism: a study of typology of artefacts, which reveal distinct changes that they underwent through time. Here, Dhavalikar has demonstrated effectively how analysis of selective common things as markers can be used to achieve objective results for understanding the process of cultural change. To cite an example, among the various markers that he has used as a case study, terracottas have proved extremely useful for determining the various sub-facets of the Early Historic period.

The last chapter is devoted to important excavations. The author has rendered a yeoman's service by incorporating essential details of important excavated sites of the historic period.

The book is a good remedial measure for a situation the author had faced while dealing with historical archaeology. It will fulfil the long-felt need for a comprehensive account of the subject under review. Needless to say, in its existing format it can serve as a good reference material for researchers in historical archaeology.

V.H. Sonawane
Dept. of Archaeology and
Ancient History
M.S. University of Baroda
Vadodara 390 002

***The Vedic People: Their History and Geography*. 2000. Rajesh Kochhar. New Delhi: Orient Longman Limited. Pages 259, Price Rs. 425/-.**

Even though a couple of Europeans, stationed in India, noted as early as the late sixteenth century, the closeness of Sanskrit with several European languages, it was (Sir) William Jones, a judge of the Supreme Court at Calcutta, who identified the close affinity of Sanskrit with Latin, Greek and several other European languages and proposed a common Proto-Indo-European language family from which its present-day branches had evolved and their ancestors had spread into large parts of Eurasia. The home of the speakers of this hypothesized language was somewhere in the grass steppes extending from north Europe to Central Asia.

Jones founded the Asiatic Society at Calcutta (now Kolkata) in 1784 which promoted scientific inquiry into all aspects of India's geography, natural history, languages and cultural history. He translated Kalidasa's play Shakuntalam, his poem, Ritusamhara, and Isha Upanishad into English, and in general, promoted the study of Sanskrit literature. Jones' exertions attracted the attention of several German, French and British intellectuals to the richness of Sanskrit language and literature, and in due course chairs of Sanskrit were established in several British, German and French universities. In the last over two centuries or so a vast body of literature, written by European, Indian and other scholars, has grown on the Indo-Europeans, Indo-Iranians, and Indo-Aryans or Vedic people. Still many controversies abound about the original home of the Indo-Aryans and the nature of their society and culture. In recent years several scholars like Bhagwan Singh (1995), Rajaram (1993), Rajaram and Frawley (1997), Jha and Rajaram (2000) and Kalyanraman (2000) have promoted a theory that the authors of the Vedas and of the Indus/Harappan Civilization were one and the same people. The extreme example of this point of view is that the Indo-Aryans did not come to India, whether by invasion or migration, from outside, but were indigenous to India and went to the West Asia and Europe from here.

Against this background for anyone to undertake a study of the origin and dispersal of the Indo-Aryans, and of their language, literature and culture is a daunting task, more so because the author of this book, Rajesh Kochhar, is neither a linguist nor a Sanskritist, archaeologist or historian. On the contrary, by profession, he is an astronomer and astrophysicist. But he has keen interest in ancient Indian history and culture. In writing this book, Kochhar has used data from a number of disciplines like Vedic and Avestan literature, linguistics, archaeology, natural history, and astronomy. He has critically examined a vast body of literature and marshalled his facts competently. The book is written in a succinct language and, as is to be expected of a natural scientist, and it makes a very pleasant and rewarding reading. In a text of just 225 pages the author has packed an enormous body of information which most other writers, including this reviewer, would take twice as many pages to write.

At the outset the author has stated the problem of the Vedic people or Indo-Aryans with a brief history of researches on Sanskrit literature and the Indo-Aryans. In chapter 3, dealing with the literary sources of ancient history, he has given a compact summary of the complex Vedic literature with minute details. The reviewer is not aware of any other source where the same information is available in such a compact and precise form. The author has described the composition and content of the four Vedas and their dating by astronomical method. In the same chapter he has described the usefulness of the Puranas, epics and Avesta for reconstructing the history of the Vedic people, and the nature of the Indo-European family of languages.

Chapter 4 deals with Puranic history, the Bharata battle, the Yuga system, date of the Bharata battle, and astronomical clues. It provides very precise information about the genealogical network of the Puranas and the historical chronology from Ikshvaku to Chandragupta Maurya.

Chapter 5, Archaeological Setting, summarizes the prehistory of the northwestern part of the subcontinent from the establishment of the first farming settlement at Mehrgarh in Baluchistan through the rise, growth and decline of the Harappan Civilization, non-Harappan Chalcolithic village cultures and up to the emergence of the first iron age cultures, namely the Painted Grey Ware and Northern Black Polished Ware, and the beginning of historical times proper in the second half of the first millenium B.C.

Chapter 6, Indo-Iranian Habitat, defines the area of the Indo-Iranians on the basis of archaeological findings and literature, and of the land of the Avestan people. The most crucial factor in this context is the natural habitat of the plant, which produced the intoxicating drink known as Soma to the Vedic people and as Haoma to the Avestan people, and which was central to the religion and rituals of both these societies. The plant is generally believed to be Ephedra. The author has identified Hindukush and its western environs as the habitat of the Soma/Haoma.

Chapter 7 discusses the location of the Rigvedic rivers which comprise the Indus river system, the Sarasvati and the Sarayu. While the author accepts the present location of almost all the rivers mentioned in the Rigveda, he locates the Sarasvati and the Sarayu in Afghanistan, identifying them with the present-day Helmand and the Hari-rud rivers, respectively. There is a long discussion on the identification of the Sarasvati with the present-day dry channel of the Ghaggar-Hakra of northwestern India and Pakistan which has been proposed by many scholars since 1874. The author, however, does not agree with this identification and is of the opinion that when the Rigvedic people arrived in the Punjab from the northwest, they gave the name Sarasvati to the Hakra after the *naditama* Sarasvati (Helmand) which they had left behind in Afghanistan. We shall return to this subject a little later.

Chapter 8 deals with the Indo-Europeans and the Indo-Iranians. Two categories of evidence are of crucial importance for identifying the Indo-European homeland. One of these is linguistic and the other is related to horse and its use for riding and for drawing wheeled vehicles like chariots and wagons. A number of words occurring in Indo-European languages are loanwords from Finno-Ugric languages. The Finno-Ugric homeland is securely placed in the resource-rich northern forest zone of Europe extending from the Baltic Sea to the eastern side of the Ural mountains. The Indo-Europeans could have borrowed words from Finno-Ugric only if the two groups had lived in the close vicinity of each other. The proto-Indo-Europeans have been assigned the contiguous territory to the south of the Finno-Ugric, that is, the resource-poor steppes bordering the Caspian and Black Seas.

Horse is a very important component of the culture and mythology of Indo-European peoples. They, and in particular the Indo-Aryans, were obsessed with this strong, agile and handsome animal and built a full-fledged cult around it and the chariot. They used the horse for riding as well for driving wheeled vehicles like chariots and wagons. It gave them great mobility which these semi-nomadic peoples used to great advantage for plundering prosperous sedentary settlements. Knowledge of copper metallurgy was essential for manufacturing wheeled vehicles. This knowledge appeared in the fifth millennium B.C. and the earliest wheeled vehicles are not older than fourth millennium B.C. Wild horses roamed the grass steppes of Central Asia and therefore they could be domesticated only in this region. The author has competently summarized a vast and complex body of archaeological evidence of the Chalcolithic cultures of Central Asia, which show the presence of horse and wheeled vehicles in graves. He identifies the European homeland to the north of the Caspian and Black Seas and the Indo-Iranian homeland to the south of these Seas. He has made out a convincing case for the original home of the Indo-Iranian speakers being outside India.

Chapter 9 is devoted to Rigvedic people and other Indic speakers. The author has made a distinction between Rigvedic people and other Indic speakers. According to him the non-Rigvedic Indic speakers arrived in India around 2000 B.C. while the Rigvedic people arrived around 1400 B.C. The composition of the Rigveda began around 1700 B.C. in Afghanistan and was completed around 900 B.C. in the Punjab.

Chapter 10 deals with the Ramayana and the Mahabharata. The author believes that the events mentioned in both these epics took place in Afghanistan, those of the Ramayana around 1450 B.C. and of the Bharata battle around 900 B.C. After the Aryans settled in India and expanded their settlement into the Indo-Gangetic Divide and the upper and middle Ganga valley, they renamed existing settlements after places like Hastinapura, Indraprastha, Kampilya, Ayodhya, Chitrakuta, etc., mentioned in these epics, after the original places in Afghanistan.

Finally, the brief chapter 11 gives a short but neat summary of the book. At the end there are notes giving details of the chapter-wise references given in Arabic numbers in the text. This is followed by a list of references.

In this otherwise meticulously documented, cogently argued, and superbly written book there are two controversial issues. These pertain to the author's location of the Rigvedic Sarasvati and the scenes of the events of the Ramayana and the Mahabharata epics.

As mentioned earlier, the Rigvedic Sarasvati has been identified for over 125 years by a number of scholars, on the basis of literary, geomorphological, historical, folkloristic, and archaeological evidences, with the dry course of the river lying between the Yamuna and the Sutlej, which is known as Ghaggar in the Indian territory and as Hakra, Sotra, Wahind and Nara in the Pakistan territory. The first researched publication on this subject appeared as early as 1874 (Anonymous 1874) in which the author demonstrated with the help of a large body of evidence from diverse sources that the dry river was indeed the bed of the Rigvedic Sarasvati which was eulogized as a mighty, perennial, and the most sacred river, flowing from the Himalayas to the sea, in many hymns of the Rigveda. In the subsequent later Vedic, Epic, and Puranic literature the Sarasvati has been described as having been lost in the sands or gone underground.

It is to be noted that all the perennial rivers of the Punjab have their origin in the Himalyan glaciers and are fed by snowmelt. They can reach the plains only through an opening in the Siwaliks. However, there is no opening in the Siwaliks between the Yamuna and the Sutlej through which a third Himalayan river could have descended into the plains. Therefore, the Sarasvati could have been a perennially flowing river only if the Sutlej or the Yamuna or both of them flowed through its channel. The author provided enough evidence to establish that the Sutlej was indeed flowing through the Sarasvati channel until the medieval period. A response to this article appeared next year under the pseudonym of Nearchus (1875). In this response the author disagreed with the anonymous author's proposition that the Sotra or Hakra was flowing into the sea at a place now represented by the Rann of Kutch. Instead, he believed that this river ended its course in the old Indus near Rori. He, however, supported the anonymous author's thesis with some minor variations. Twelve years later R.D. Oldham, an officer of the Geological Survey of India, published an article on changes in the courses of the Punjab rivers and strongly supported the anonymous author's thesis (Oldham 1887). Six years later Surgeon-Major C.F. Oldham (1893) published an article on the lost Sarasvati. The author marshalled a large body of varied evidence to demonstrate that the Sutlej was definitely flowing in the Sarasvati channel and he left the possibility of the Yamuna also doing so open. In its content, language and style this article bears such close identity to the anonymous article that there is little doubt that the author of the latter is none other than C.F. Oldham.

In the winter of 1941-42, the eminent explorer, Sir Aurel Stein (1942), carried out an archaeological survey along the course of the Ghaggar-Hakra in the then Bikaner and Bahawalpur Princely States. He located around 50 Chalcolithic sites, including the now-famous Harappan site of Kalibangan, which he mistakenly identified as Early Historic. Stein identified the Ghaggar-Hakra with the Rigvedic Sarasvati and produced a large body of literary, geomorphic, historical and folkloristic evidence in support of his hypothesis. He proposed that the Sutlej was flowing during the Rigvedic period through the present Ghaggar-Hakra course and was therefore responsible for the perennial flow of the Rigvedic Sarasvati. He also pointed out that the many abandoned channels of the Sutlej were utilized by British surveyors for laying the modern canal network in the Punjab. More Harappan sites were added in the Ganganagar and Hanumangarh districts of Rajasthan (both part of the former Bikaner Princely State) by A. Ghosh (1952) and Katy Dalal (1980) who explored Ghaggar valley in this region after Independence.

When the site of Kalibangan was being excavated in the sixties, American hydrologist-archaeologist, R.L. Raikes (1968) dug bore holes in the Ghaggar bed at this site down to a depth of 11 m below the present flood plain level of the river. Below 11 m Raikes found alternating layers of "coarse grey sand very similar in mineral content to that found in the present day Yamuna". Above the 11 m depth he found "mainly clays and silts typical of present day flood plain deposits". Basing his arguments on calculations for the rates of sedimentation, location of archaeological sites of Harappan, PGW and Rang Mahal cultures in the Ghaggar valley, and the thickness of deposits at these sites, Raikes postulated alternate captures of the Ghaggar channel by the Indus and the Ganga systems through the Sutlej and the Yamuna, respectively. He proposed six episodes of these captures between 2500 B.C. and 500 A.D.

Suraj Bhan (1973) carried out extensive explorations of Harappan sites in Haryana and excavated a few of them in the sixties of the last century. He has demonstrated eastward shift of the Yamuna through several channels. One of these channels starts from near Indri, 20 km north of Karnal, and is traceable for a distance of 180 km up to Tigrana near Tosam in the southwest. This channel runs along the course of the West Yamuna canal up to Mundak and then along the Jind branch of the same canal up to Safidom. The channel is marked by sand dunes along its banks, a regular band of freshwater vegetation in its course, and thick deposits of the grey sands so typical of the Yamuna, in the wells dug in its channel. Local tradition also associates this channel with the old course of the Yamuna. Suraj Bhan has located 18 Harappan and two PGW sites on this channel. The scarcity of PGW sites here suggests that the Yamuna had already shifted eastward during the Late Harappan period. Suraj Bhan has located two more channels further east with Late Harappan and PGW sites on them, thus providing further evidence for the eastward shift of the Yamuna.

More than three decades ago, German geographer, Herbert Wilhelmy (1969) published a comprehensive paper summarizing all the evidence then available, barring that relating to the Harappan Civilization, about the history of the Sarasvati river. He argued that the Yamuna was flowing into the Ghaggar-Hakra (Sarasvati) channel as the Rigvedic Drishadvati (present-day Chautang or Chitrang) up to 1500 B.C. Similarly, the Sutlej was also flowing into the Ghaggar-Hakra bed up to 600 B.C. It is only after this date that that the Sutlej joined the Beas and, further down, the Indus. Wilhelmy published several maps showing the position of the Sarasvati, Drishadvati, Yamuna, Sutlej and Beas at 2000 B.C., 1500-1000 B.C., 600 B.C., 500 B.C.-1000 A.D., 1300-1500 A.D. and in 1940 A.D. The last map also shows the modern canal network of the Punjab and Haryana which has utilized the old channels of the Yamuna and the Sutlej.

The reviewer (Misra 1984) published a comprehensive paper incorporating information available in all the publications cited above. Plotting all the Harappan sites known at that time on a map, he found that majority of them are concentrated on the main course and abandoned channels of the Ghaggar-Hakra, including the channel of the ancient Drishadvati or modern Chautang, particularly those of the Hakra Ware Culture and Early and Mature Harappan phases of the Harappa culture. The densest concentration of these sites is in the Cholistan desert of the Bahawalpur region of Pakistan (Mughal 1981). In contrast, sites of the Late Harappan phase are scarce on the main course of the Ghaggar-Hakra but have a dense concentration on its tributaries in Haryana, in the foothill zone of the Siwaliks in the Punjab, in the Yamuna-Ganga doab in northwestern Uttar Pradesh, and in Saurashtra. The map also revealed that Harappan sites of all phases were conspicuous by their absence on the Yamuna as well as on the Sutlej, barring the upper course of the latter river where it flows in an almost east-west direction parallel to the Siwaliks.

The conclusions which emerge from this exercise can be summarised as follows:

a) The Ghaggar-Hakra channel can be traced from the Siwaliks to the Rann of Kutch lying, in its southern part, parallel to, and east of the Indus channel. It has a length of over 1500 km and an average width of 10 km. Its bed is lined with loam and its banks consist of thick sand deposits.

b) All through its course the channel lies in a sandy desert where the rainfall is scanty and it has no tributaries except in its upper course in the eastern part of Bahawalpur in Pakistan and in northern Rajasthan, Haryana and the Punjab.

c) The vivid description of the Sarasvati as a perennially flowing, mighty and most sacred river in many hymns of the Rigveda, and the largest concentration of Harappan sites on the Ghaggar-Hakra course clearly establish that the Rigvedic Sarasvati and the present-day Ghaggar-Hakra are one and the same river, as has been argued by many geographers, geologists, historians, and archaeologists for more than a century.

d) Over 900 Harappan settlements on the Ghaggar-Hakra would have contained at least a million people. Such a large human population and perhaps an equally large livestock population could not have been sustained in a rainless, scorching, sandy desert unless the Ghaggar-Hakra/ancient Sarasvati was a perennially flowing river.

e) All the perennial rivers of northwest India originate in the Himalayas and are fed by the snowmelt of the glaciers. To reach the plains they have to find an outlet through the Siwaliks which run parallel to the Himalayas.

f) The course of the Ghaggar-Hakra/Sarasvati lies between the Sutlej and the Yamuna, and there is no opening in the Siwaliks between these two rivers through which a third Himalayan river could have descended into the plains. Therefore, as was suggested by the anonymous writer in 1874 and by C.F. Oldham in 1893, the Sarasvati could have been a perennially flowing river only if the Sutlej or the Yamuna or both of them flowed through its channel in the past. The total absence of the Harappan sites on the Yamuna and the Sutlej, together with a large body of geomorphic, historical and folkloristic evidence, clearly establishes that both the Sutlej and the Yamuna were not flowing in their present channels during the Harappan times but were flowing through the Sarasvati channel. In contrast, the presence of many sites of the Painted Grey Ware (PGW) culture, which is identified with the Mahabharata sites and is dated to c. 1000-600 B.C., on the Yamuna clearly shows that the Yamuna had started flowing in its present channel and had got separated from the Sarasvati before 1000 B.C.

The reviewer published another paper on this subject ten years later (Misra 1994). In this paper, he could strengthen his arguments presented in the earlier paper with the help of the regional counts of Harappan sites in India and detailed distribution maps published by J.P. Joshi, Madhu Bala and Jassu Ram (1984). The two papers also discuss in detail the processes involved in the shifting of the courses of the Sutlej and the Yamuna, and so it is not necessary to repeat them here.

Coming back to Kochhar, he accepts the present location of all the Rigvedic rivers except the Sarasvati and the Sarayu. Regarding the latter river his position is perfectly understandable because the present Sarayu is located in central Uttar Pradesh, which area, lying to the east of the Ganga, was totally unknown to the Rigvedic people. In the case of the Sarasvati, however, his attempt to identify it with the Helmand in Afghanistan is totally inexplicable because so many scholars over last one-and-a-quarter century have identified it with the Ghaggar-Hakra with the support of a formidable body of literary, geomorphic, archaeological, historic, and folkloristic evidence. What is even more surprising is that the author was aware of all the literature cited by the reviewer because he has cited the reviewer's 1994 paper and Wilhelmy's 1965 paper in his book. Despite that he has totally ignored almost all this literature. He has cited two papers by M. Stein. Actually, the author of both these papers is Aurel Stein. But he has not used two other papers by Aurel Stein (1917, 1942) which are relevant to the Sarasvati problem. Regarding the history of the Yamuna the author says (p. 223) that "Many geologists believe that the Yamuna has been flowing in its present channel for at least the last 20,000 years" but he does not mention the name or citation of even one of these geologists.

Equally difficult to accept is the author's location of the events and places of the Mahabharata and the Ramayana epics in Afghanistan. The author has argued that the composition of the Rigveda began in Afghanistan around 1700 B.C. and was completed in the Punjab by 900 B.C. He places Rama at around 1450 B.C. and Krishna around 900 B.C. According to him, the existing places like Hastinapura, Indraprastha, Ayodhya, Chitrakuta and Bharadwaja Ashrama bearing names of the places mentioned in the Mahabharata and the Ramayana, were named after the places which the Aryans had left behind in Afghanistan. There is scope for a lengthy discussion on this problem. But here only a few questions will suffice. If the epic events took place in Afghanistan, do the tradition of these events and the names of the places mentioned in the epics survive in Afghanistan? To the best of the reviewer's knowledge the answer to this question is NO. The second question is that after leaving Afghanistan the Aryans lived for several centuries in what is now Pakistan. Did they name places in the Pakistan territory after the epic places? The Aryans reached the Ganga valley only in the first millennium B.C., the Indo-Gangetic Divide and the Upper Ganga valley (where the Mahabharata named places are found) around 900 B.C. , and the Middle Ganga valley, i.e. eastern Uttar Pradesh and Bihar (where the Ramayana named places are found) only around 700 B.C. If the Mahabharata events took place in Afghanistan around 900 B.C. and when the PGW culture associated with the Mahabharat places appears in the Ganga valley around 1000B.C., where does the question of the Indo-Aryans of Afghanistan naming places of their earlier homeland in the Ganga valley arise? The third question is that since the Ramayana named sites in the middle Ganga valley are younger by more than seven centuries than the date of Rama placed by the author at 1450 B.C. in Afghanistan, why had the Aryans to wait for over seven centuries to name places after the Ramayana in their new home? Also, why did they not locate these places in the vast territory lying between Afghanistan and eastern Uttar Pradesh where they must have lived before reaching eastern Uttar Pradesh. Finally, if, according to the author, the Ramayana predates the Mahabharata by more than five centuries, why does the archaeological evidence from the epic sites show the reverse situation? The European migrants to the New World and Australia named places in their new home after the places in their old home but they did so immediately after their arrival in the new home when they were still nostalgic about the old familiar places and not after several centuries?

The author has not even asked these questions and so the question of answering them does not arise.

The reviewer would like to repeat that but for these two controversial issues, the book makes an original and important contribution to the problem of the Vedic people and is eminently readable. Professor Kochhar deserves all congratulations for his contribution.

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V.N.Misra
G-2, B Wing, Ganga Park
Mundhwa Road
Pune 411 036

INDIAN SOCIETY FOR PREHISTORIC AND QUATERNARY STUDIES

c/o Department of Archaeology, Deccan College, Pune 411 006

BALANCE SHEET AS ON 31st MARCH 2001

Funds and Liabilities	Rs.	Rs.	Property and Assets	Rs.	Rs.
Trust Funds or corpus Bal. as per prev. B/S	558,543.40		Immovable Properties		
Ajustment during the year			Bal. as per prev. B/S	00.00	
(Donations recd during the year)	00.00	558,543.40	Add: During the year	00.00	
			Less: Sold during the year	00.00	
Other Earmarked Funds—	83,607.95		Less: Depreciation @ 5%	00.00	00.00
(Created under the provisions of the trust					
deed or scheme or out of the income)			Investments (As per Schedule II)		1,243,632.56
Depreciation fund	00.00				
Sinking fund	00.00		Other Movable Properties (As per Schedule III)		90,983.46
Reserve fund	663,629.74	747,237.69			
			Bal. as per prev. B/S.		
Loans (Secured/Unsecured)			Add: During the year	00.00	
(As per schedule)			Less: Sold during the year	00.00	
For expenses	00.00		Less: Depreciation @ 5%	00.00	
For Advance	00.00	00.00	Loans (Secured and Unsecured)	00.00	
			Loans Scholarships	00.00	
For rent and other deposits	00.00		Other Loans and Advances	00.00	
Audit fee	200.00		Cash & Bank balance	00.00	00.00
Provision for Contribution	788.94	988.94			
			Cash and Bank Balances	00.00	
Income & Expenditure A/c					
Bal. as per prev B/S	00.00		Income Outstanding		
Less: Appropriation if any	00.00		Rent, Interest, Other Income	00.00	
Add: Surplus per inc & Exp A/c	114,178.25	114,178.25	Cash	2,749.50	
			Bank Balances	82,817.22	
			Amts Receivable	765.54	86,332.26
			Income & Expenditure A/c		
			Bal. as per pre B/S	00.00	
			Add: Deficit for the year	00.00	00.00
Total Rs.		1,420,948.28	Toral Rs.		1,420,948.28

As our report of even date

FOR A.S. CHANDVANKER & CO., CHARTERED ACCOUNTANTS

Date: 16.08.2001
Place: PUNE

A.S. CHANDVANKER

GENERAL SECRETARY JOINT SECRETARY TREASURER

INDIAN SOCIETY FOR PREHISTORIC AND QUATERNARY STUDIES,
c/o Department of Archaeology, Deccan College, Pune.
INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDING 31st MARCH 2001

Expenditure	Rs.	Rs.	Income	Rs.	Rs.
To Expenditure in respect of			By Rent* (Accrued/Realised)		00.00
Properties					
Rent, Taxes, Cases			By interest* (Accrued/Realised)		
Repairs and Maintance			On Securities	00.00	
Salaries			On Deposits	79,414.37	
Depreciation (by way of prov. or adjustment)		00.00	On Loan	00.00	
Other expenses			On Bank Account	2,350.00	81,764.37
To Establishment Expenses			By Divident	00.00	
To Renumeration to Trustees			By Donation in Cash or Kind	00.00	
To Remuneration (in the case of Math) to the head of			By Grants (Publication)	50,000.00	50,000.00
Math including his household expenditure			By Income from other sources in details as far		
To Legal Fees			as possible	00.00	
To Interest Paid			– Conference Grant Received	126,000.00	
To Audit Fees		2,000.00	Life Membership Fees	35,500.00	
To Contribution and Fees			M&E Volume Sale	35,776.00	
To Amount Written Off			Sale of DHP	450.00	
To Miscellaneous Expenses		00.00	– Cost of Offprints	150.00	
To Depreciation		23,199.71	– Institutional Subscription	1,120.00	
To Amount Transferred to Reserve or Specific Fund		192,745.91	– Misc. Income	1,363.50	200,359.50
To Expenditure on Object of the Trust (as per Schedule 'A')		00.00	By Transfer from Reserve		
To Surplus carried over to B/S		114,178.25	By Deficit carried over to B/S		
Total Rs.		332,123.87	Total Rs.		332,123.87

As our report of even date

FOR A.S. CHANDVANKER & CO., CHARTERED ACCOUNTANTS

Date: 16.08.2001
Place: PUNE

A.S. CHANDVANKER

GENERAL SECRETARY JOINT SECRETARY TREASURER

Man and Environment

Journal of the
Indian Society for
Prehistoric and Quaternary Studies

Volume XXVI, No. 2 (July-December 2001)

06/3/03

Indian Society for Prehistoric and Quaternary Studies

c/o Department of Archaeology
Deccan College
Pune 411 006, India

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Change of address should be immediately communicated to the General Secretary to ensure prompt despatch and safe delivery of the Journal, conference circulars, etc.

Cover: Drawing of the bowl of one of the Black-and-Red ware, from Balathal, Rajasthan.

Editorial

This issue continues with the earlier tradition of publishing articles on diverse topics of archaeology and allied disciplines. The articles in this issue span the range from Man-environment interaction, monsoons and civilisation, Quaternary geology, Palaeolithic studies, Neolithic fauna, metal objects and metallurgy, Harappan and OCP ceramics, Chalcolithic pottery, and glass bead manufacture.

We have two interesting articles from senior archaeologists, M.K. Dhavalikar and K. Thimma Reddy. Both have addressed the issue of man-nature interaction and its significance to our understanding of the archaeological past. Dhavalikar highlights the importance of the monsoon behaviour in antiquity and the nature of human response to its dynamics. Thimma Reddy focuses his attention on the role of environment in archaeological studies and stresses the need of recognising the importance of the relationship between culture and environment. K. Paddayya and Richa Jhaldiyal highlight the role of surface sites in Palaeolithic research, using a case study from the Hunsgi and Baichbal valleys in Karnataka. Hema Achyuthan and her colleagues report the discovery of a spectacular gorge near Pondicherry and talk about Holocene episodes of colluvial deposition.

Ravi Korisettar and his associated report the results of their re-investigation of seven sites of the Southern Neolithic culture from Karnataka and Andhra Pradesh, with particular emphasis on faunal remains. There are two articles on metal objects found in Uttar Pradesh, one on the copper vessels and iron swords from the early Iron Age site of Agiabir in Mirzapur District by Purushottam Singh and Ashok Kumar Singh, and the other on the metallurgical analysis of a copper anthropomorph from the OCP site of Madarpur in Moradabad District by R. Balasubramaniam and others. M.D.N. Sahi draws our attention to the genetic relationship of the OCP with the Harappan ware. V.N. Misra and R.K. Mohanty report the discovery of a rare Chalcolithic pottery cache from Balathal in Udaipur District of Rajasthan. Finally, Alok Kumar Kanungo discusses various aspects of glass bead manufacturing technology in India.

All the articles are original in nature and they deal with theoretical, fieldwork as well as laboratory issues. Those by Singh and Singh and by Misra and Mohanty report exciting new discoveries. The issue also carries reviews of four new books, namely *Acheulian Culture in Peninsular India* by R.S. Pappu, *The Saraswati Flows On: The Continuity of Indian Culture* by B.B. Lal, *Rock Art in Orissa* by Sadasiba Pradhan, and *Carnelian Beads in Khambat* by Valentine Roux. Taken as a whole, the issue makes a solid contribution to our knowledge of the Indian archaeology from the Palaeolithic to the Early Historic period.

The Editorial Board of the Journal is fully conscious of the inordinately long delay in the publication of this issue. We feel deeply embarrassed by enquires from the valued Life Members of the Society and from our equally important distributors. However, the main factor responsible for the delay is beyond our control. The publication of the December issue coincides with the field season in India. As all members of the Board are involved in fieldwork, they were away from the headquarters for varying lengths of time from November to March, and therefore proof reading of the articles and other items was delayed. We are sincerely trying that the next issue (XXVII (1)), due in June 2002, will appear in time and we will back on the schedule. This issue, guest edited by one of our young life members, Sunil Gupta, is devoted to the important theme of archaeology of the Indian Ocean.

We are glad to announce that a monograph entitled, *Biological Anthropology of Human Skeletal Remains from Bhimbetka, Central India*, the important Palaeolithic and Mesolithic rock-shelter site, excavated in the seventies of the last century, the second publication in the Society's Monograph Series, will be out by the end of May, 2002. It will be available in hardbound (Rs. 250/-) as well as paperback editions (Rs. 190/-). The Society's Life Members will be entitled to buy paperback edition at a special price (Rs. 150/-). They as well as our distributors are advised to address their enquiries to the General Secretary of the Society.

We feel very sad to announce the passing away, during last seven months, of several distinguished archaeologists, who have made invaluable and abiding contribution to South Asian archaeology by their lifelong dedicated work. These include Krishna Deva (08.10.2001), Ajay Mitra Shastri (11.01.2002), J. Desmond Clark (15.02.2002) and B.P. Sinha (03.05.2002). We deeply mourn the death of these veteran scholars and sympathise with their families. An obituary of Krishna Devji appears in this issue. Obituaries of the remaining three scholars will appear in the next issue.

The publication of this Journal has been financially supported by the Indian Council of Historical Research (ICHR) and the Archaeological Survey of India (ASI). The responsibility for the facts stated, opinions expressed, or conclusions reached is entirely that of the contributors of the articles. The ICHR and ASI accept no responsibility for them.

Archaeology of the Eastern Ghats: an Ecological Overview[1]

K. Thimma Reddy

Department of Anthropology
Andhra University
Visakhapatnam 530 003

I wish to share some of my personal observations from the studies in the *Eastern Ghats* region in Andhra Pradesh with the distinguished scholars attending this conference. India with its varied geo-cultural entities has preserved very rich archaeological heritage. We are aware of the genesis of archaeological studies in India from reports on the occurrence of artefacts, typo-technological, chronological and descriptive stages to interpretation and analysis level of culture histories. A review of these may not be very pertinent at this moment, as all of you are well familiar with the growth of Indian archaeology. What is significant is the volume and variety of archaeological data, which increases as one moves from the beginning of Stone Age towards the emergence of village communities and later on urban centres. One makes an effort to build up culture history at the site/settlement/micro level, particularly in the later phases of culture history. One can be proud of the contribution to our knowledge of archaeological cultures. But several questions remain, difficult to answer. Indian archaeologists have not built theories and methodologies to test hypotheses as New World and European archaeologists have done. This reference to theory and method is made here simply to make us ponder over whether the data that we have generated presents the variety of cultural traits and associated natural features to enable us to reconstruct culture, culture history and the process of culture change. I must mention that a few Indian archaeologist with institutional support did generate the data, to some extent, in the areas of protohistoric and early historic periods. I would also like to mention that archaeologists are dealing with cultures thereby with people, even if it is based mainly on artefacts or technology. Culture studies need to be based on a holistic approach as conceptualised by anthropologists. Anthropologists define culture in many ways. The most appropriate definition of culture relevant to archaeologists is that of Bidney (1953) as comprising socifacts, mentifacts, and artefacts where the former two revolve around the artefacts. 'Artefact' is the concern of technology, which means that socio-economic and behavioural aspects of culture revolve around technology. In other words, technology forms the basis for reconstruction of socio-economies of any population. We are aware that technology during pre- and proto historic periods brought changes in artefact typologies in an evolutionary perspective, reflecting cultural evolution. Several anthropologists have questioned the culture studies without reference to the environments in which these cultures flourished. Thus environment is brought into archaeological studies stressing the importance of the relationship between culture and environment.

Steward (1963) and White (1959) have broadened the understanding of culture and environment into an interaction between human cultural systems and their natural environmental components. Any change in any environmental component resulted in the change of one or more attributes of culture. This is termed as 'cultural ecology'. Several studies have shown that successful adaptive patterns continued in use and acted as an important stabilising factor over a long period of time. Anthropological studies have revealed culture variability at micro-level or ecosystem level. In India archaeologists, have realised the significance of these methods but very few have ventured to apply the method to understanding culture change at micro level. This method necessitates the systems theory approach with which most of us are either not familiar or have very limited data to attempt it. Whatever be the status, it needs to bed emphasised that archaeological culture have to be studied in the context of ecosystem. Culture provides a protective mechanism to man against environment through technology. Culture has ability for quick modification and transmission from one individual to the other, from one generation to another. More efficient cultures become popular within a short span of time and are adopted to rise to dominance.

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[1] Presidential Address delivered during the XXIX Annual Conference of the Indian Society for Prehistoric and Quaternary Studies, held at M S. University of Baroda, 22-24 November 2001.

Morgan (1877) and Childe (1953) have given us a better understanding of the origin and evolution of culture. Morgan's culture evolution model was based on socifacts of contemporary primitive societies, while Childe's model was based on the then available archaeological data. Each of these project a universal picture of cultural evolution. This model gives an impression as if history/culture evolution has a predetermined sequence that culture evolution has some directions. But that doesn't answer certain questions like whether the sequential order of cultural evolution is uniform or contemporary?, why the pace of development of culture is slow in some societies, while it is fast in others? This model also doesn't augur well with culture-ecology model. In other words, unless a given culture is studied in its totality including the environmental resources, our understanding of culture change and process of change remains incomplete.

In the light of this brief sketch of culture history, culture evolution and culture ecology, I would like to present my field observations in the archaeology of the Eastern Ghats in general and Cuddapah Basin in particular. Cuddapah basin, a geological formation, with a crescent shape in the south central part of Andhra Pradesh, stretches over an area of 44,500 km^2 in parts of Chittoor, Anantapur, Cuddapah, Kurnool, Mahboobnagar, Nalgonda, Krishna, Guntur, Prakasam and Nellore districts. The *Nallamalais*, *Seshachalams*, *Velikondas* and *Erramalais* are the important hill ranges of the Cuddapah basin of the Eastern Ghats. The credit for bringing to light the earliest record of prehistoric cultures in these ranges goes to Robert Bruce Foote (1916).

My intention of pointing out these general observations to you is to look into the Indian archaeological data and to rethink on the origin and contemporariness of archaeological culture in a local and regional context rather than in a pan Indian context. We have encountered a situation in the *Nallamalai* hills (14^0 30' and 17^0 0'; 78^0 35' and 78^0 57' E) in general and Srisailam plateau in particular, which needs an explanation. The *Nallamalai* hill ranges cover an area of about 5400 km^2. and are inhabited by about 6000 Chenchu households. These ranges lie to the west and northwest of Cuddapah basin. The Srisailam plateau lies at the centre of the *Nallamalais*. The Chenchus, a primitive tribe practicing a simple technology and hunting- gathering inhibit this plateau. Expeditions were carried in the hill tracts by the faculty of the School of History, Culture and Archaeology of Telugu University, along the ancient footpaths from the north, south, east, and west directions leading to Srisailam sacred complex. The distance from the foothills to the Srisailam sacred complex varies from about 40 to 80 km.

The expeditions brought to light several Palaeolithic findspots. Fifteen Lower Palaeolithic, eight Middle Palaeolithic and six Middle and Upper Palaeolithic scatters were discovered. Most of the spots have artefact scatters on flat rock surfaces but their concentration is found near the perennial water sources like springs and waterholes. The occurrence of a few handaxes, cleavers, choppers flake tools, flake blades and blades are recorded. Of the several such findspots two Palaeolithic occupations, one at Kadilivanam and the other at Srisailam temple complex, are of great interest. A huge cave at Kadilivanam, measuring about 150 x 5 x 5 m, could give shelter to hundreds of pilgrims *en route* to Srisailam. The entire cave debris was removed by one of the *yogins* of Karnataka, exposing flat rock base, a couple of years before the expedition. The debris thrown into the valley is full of flake blades, blades and tools. While on the top of the cave and its environs a heavy concentration of artefacts running into several thousands, and comprising flake-blades, blades and tools were noticed. Another site behind the temple at Srisailam exhibited a similar concentration of artefacts on the rock surface and crevices. Therefore, a detailed study of the site was carried out (Raju *et al.* 1997) Artefacts number more than 30,000 over an area of about 8,000 m^2 and comprise flake blades, blades, cores, hammerstones and anvils. Blunted back blades are conspicuous by their absence in this assemblage.

Large size blades, flakeblades and flakes are attributed to Middle and early Upper Palaeolithic cultures. Lower Palaeolithic evidence is mostly found at the peripheries (opening into the plains) of the plateau while Middle and Upper Palaeolithic evidence is abundant on the plateau. Explorations didn't yield evidence of Mesolithic and Neolithic remains. The absence of these two cultural phases is intriguing. The Srisailam Plateau, thus, appears to have been occupied by the people of the Middle and the Upper Palaeolithic culture. Its peripheries are inhabited by the people of Late Acheulian culture followed by Middle and Upper Palaeolithic, Mesolithic and Neolithic cultures.

Moving away north from Srisailam Plateau to the peripheries of the *Nallamalais* is the Mannanur Plateau from where a number of Late Acheulian findspots comprising handaxe-cleaver complex are reported (Sastry 1983). To the northeast of the plateau is the well-known Nagarjunakonda with its abundant evidence of Palaeolithic, Mesolithic and Neolithic cultural remains (Soundararajan1958; Subramanyam 1975). . South of the Srisailam Plateau, rivers such as *Bhavanasi, Tigaleru, Sagileru and Gundlakamma,* with a network of streams and streamlets, originate in the *Nallamalais* and flow either to the west or the east. The

Lower Palaeolithic artefacts including pebble tools, crude handaxes, cleavers, flake choppers and scrapers, etc., are found either on stream/river beds, river banks, foot hills, and a few in a stratified context. At several open-air findspots, Lower Palaeolithic artefacts are found mixed with Middle Palaeolithic flake-tool assemblages. The upper and middle reaches of the *Bhavanasi, Gundlakamma* and *Sagileru* are rich in Lower and Middle Palaeolithic evidences (Soundara Rajan1952; Isaac 1960; Reddy 1968). The proportion of Soan type of flat-based unifacial and bifacial pebble tools to handaxes is 2:3. This is also confirmed by a small excavation at Nandipalli in the *Sagileru* valley (Reddy 1969). Even in the Bokkineru (*Sagileru* valley) streambed, evidence of large flake choppers and flakes being detached from huge pebbly boulders marks a distinct technology. This observation is made not to project flake choppers and pebble tools either as contemporary to Soan or Pre-Acheulian. It is just to show the prevalence of the flake /pebble tools as a part of Acheulian, which could be divided on the basis of typo-technology and to a little extent patination/ weathering into Lower, Middle and Upper Acheulian.

The Middle Palaeolithic flake and flakeblade assemblages with a considerable percentage of faceted flake element, are widely found in the *Bhavanasi, Tigaleru, Gundlakamma* and *Sagileru* valleys. The number of sites reported is very small. It is not an exaggeration to state that as one gets down from the road into the cultivated fields one can easily pick up flakes, flake tools and cores, etc., in these river catchment areas. Investigators, including myself, did not pay proper attention to the situation where extensive Middle Palaeolithic scatters far exceed Lower and Upper Palaeolithic scatters and the mixed assemblages of the Lower and the Middle Palaeolithic in an open air context.

The Upper Palaeolithic industry with blunted back-blades is found at a few sites of which Yerragondapalem and Nandipalli are important, and is dated to 24,000 years BP (Reddy and Sudarsan 1978). Flakeblades and blades, though found with Middle Palaeolithic flake assemblages are identified as distinct from the Middle Palaeolithic and referred as Series III (Cammiade and Burkitt 1930; Isaac 1960).

The *Seshachalam* and *Vellikondas* hills to the south and east of the *Nallamalais*, which bound the Cuddapah basin are no less important for the extensive evidence of the Late Acheulian and flakeblade complex of the Middle Palaeolithic. The Tirupathi valley, in the Seshachalam peripheries, has revealed intensive occupation of the Late Acheulian artefacts being made on flakes and elongated flakeblades, flake, flakeblade complex (Jayaraj 1983). Renigunta (Swarnamukhi river valley), Pedarachapalli and other sites in the Gunjan valley are noteworthy for the Upper Palaeolithic evidence (Murty 1966; Raju 1988). I would like to refer to an analysis of the handaxes from the *Venkatagiri, Boggeru* and *Kandleru* rivers originating in the *Velikondas* and flowing east into the Bay of Bengal (Sudarsan 1976), which has indicated that the Lower Palaeolithic handaxes from Venkatagiri river valley are distinct from those in other river valleys, in that the well defined handaxes are predominant, perhaps due to its proximity to Tirupathi valley. The artefact scatters in the laterite belt between the hills and the coast are similar to the *Nallamalai* situation. The Paleru River has preserved evidence of rich Upper Palaeolithic blade industry (Madhusudan Rao 1979). The discovery of rhinoceros remains in the *Gundlakamma* (GSI 2000), which is also recorded in the Billasargams cave, throw light on the environmental conditions in the area.

This brief survey makes it very clear that in the Cuddapah basin, the *Nallamalais.* the *Seshachalams* and the *Velikondas*, the Middle Palaeolithic culture is widespread and that they were also occupied by people with handaxe-cleaver. Huge flake choppers and pebble tools in the Sagileru valley may indicate the initial stages of typo-technology. The Mesolithic findspots are fewer in number and they are adaptation to aqua environment east of Sehachalam hills.

Moving west of the Cuddapah basin into the limestone formation of the *Erramalais* and granite-gneiss and schist belt bordering Karnataka, we enter into an important area of colonization during the Holocene period. Barring Billasurgam group of caves (Murty and Reddy 1976; Reddy 1980) in the *Erramalais* where the evidence of the Upper Palaeolithic comprising blade industry on limestone and bone with a large number of animal remains of *Elephas, Bos, Rhinocero*, etc., are recovered, the rest of the *Erramalais* and granite-gneiss and schist belt has produced extensive Mesolithic and Neolithic cultural evidences, including rock art.

The rock art, depicting a variety of animals, birds and human postures in association with microliths at some sites is recorded. Ketavaram, Kalvabugga and Puricherlla sites in the limestone formations, Budagavi, Dupadugutta, Sanganonipalli, and score of other sites in the granite-gneiss and schist belt have extensive rock art (Chandramouli 1995). The absence or sparse Palaeolithic evidence perhaps, indicates first colonisation of the area by the Mesolithic folk, followed by the Neolithic people (Reddy 1968; Sankalia 1974). Weathered horizon and small, shallow depressions with more open land are characteristic features of the granite-gneiss and schist belt which might have provided water and small game in a shrub-jungle for subsistence.

While this is the picture in the Cuddapah basin (southern Eastern Ghats), very important geo-archaeological and ethnoarchaeological findings have been made on the Visakhapatnam coast and in the northern part of the Eastern Ghats. Along the shore, a number of rock promontories of isolated hill ranges of the Eastern Ghats jut into the sea as headlines. Rock-cut terraces and caves of marine origin are at elevation of + 7 m at a number of places, the prominent being Rushikonda (Reddy 1994) have been tentatively identified as products of the Riss Wurm Interglacial when the sea level was estimated to be at + 7 m above the present and dated to 125,000 years (Selivanov 1991:144). Occurrence of pebble tools of the Lower Palaeolithic *in situ*, in terrace I (Maddigedda) at an elevation of + 7 m and juxtaposing with the wave-cut terrace at + 7 m elevation puts the pebble tools at 125,000 years B.P. (Reddy *et al.* 1995). On the eroded rock surface at Rushikonda, artefacts characterising the Middle, Upper Palaeolithic and Mesolithic, are found. Prakash (198, 1989) has discovered handaxe–cleaver complex from the adjacent site in the lateritic context. At Ramayogiagraharam, north of Rushikonda, in the 'red beds' between Visakhapatnam and Bhiminipatnam, excavations have revealed successive occupation of the Middle and Upper Palaeolithic and Mesolithic cultures. The Neolithic evidence is found on the surface (Rath *et al.* 1997). Neolithic evidence is extensively found between the coast and the foothills. The significant contribution of the study is that the formation of red beds dates to pre Middle Palaeolithic and their genesis to fluvial, marine, and aeolian activity with two distinct environmental markers. Analysis of Neolithic settlements, small and compact on the coast, semi-compact in the plains and scattered in the peripheries of hill tracts (Naseem 1981), which are typical of present rural settlements was done. The Neolithic settlements by the side of tribal settlements were observed in Srisailam region (Rao 1986).

As one moves into the hilly tracts of the Eastern Ghats (Visakhapatnam and adjoining districts of Orissa) with an average elevation of about 1000 m, dry deciduous, moist forest, which support a number of tribal communities, it is observed that the archaeological evidence in the hilly tracts begins and ends with the Mesolithic culture. Extensive Neolithic evidence characterised by ground and polished stone tools, microliths, pottery, dwelling units, etc., recorded between the coast and foothills, is conspicuous by its absence in the hilly tracts.

The Mesolithic evidence is recovered from isolated flat hilltops, foothills, rock shelters and caves in the hill tracts in Patala river valley (Murty 1986) and Machkund valley. Geometric forms with occasional potsherds and heavy-duty tools indicate a later phase of Mesolithic culture. Vangasari and Bodiguda rock shelters have yielded rich microlithic industry and some faunal remains (Prakash 1998). The microlithic scatters and tribal settlements are found side by side. A broad correlation of density of Mesolithic occupations and tribal settlements is made. An interesting observation is that cultivated rice, pulses and millets have genetic link with wild varieties of *Oryza ruphipogon, Oryza officinalis, Eleusine coracana, Panicum miliacenum, Panicum sumatrensis, Setaria italica, Atylosia cajanifoli*, etc., (personal communication :Shri M. Venkaiah, Department of Botany, Andhra University) found in the area. Now the question is who introduced cultivation, particularly of the local wild varieties in the absence of Neolithic phase, which is generally understood as a stage marking incipient cultivation.

This brief summary gives an idea of the distribution of Palaeolithic, Mesolithic, and Neolithic culture evidence in the Eastern Ghats region of Andhra Pradesh. It also reveals two distinct situations, one that of Srisailam plateau and Machkund valley and two that of Cuddapah basin and Visakhapatnam coast and plains with varied picture of cultural origin, continuity and discontinuity. Most of the findings, are the result of surveys. In the absence of variability of archaeological data or number of cultural and environmental components and correlates, if an attempt is made to explain, only alternative, is either to look at ethnographic present or general eco-zone dependent.

The Eastern Ghats running parallel to the coast of Bay of Bengal (Fig. 1) and its environs in Andhra Pradesh have been the habitat for 22 tribal communities whose economies and technologies vary (Mohan Rao 1993). In the south zone Eastern Ghats the Chenchu and Yanadi are the hill tribes. In the north zone Eastern Ghats tribes such as Konda Reddy, Koya, Gadaba, Bhagatha, Kondh, Jatapu, Nookadora, Kondadora, Poroja and Savara are the prominent groups. In the north zone the tribal people practise either one or combinations of several economic systems for their subsistence. Primitive tribal groups such as the Konda Reddy and Savara , appropriate forest resources for their subsistence while the tribes like Koya, Kondadora, Nookradora, Poroja and Kotia, primarily subsist on shifting cultivation, complementing it with gathering plant food resources and sale of minor forest produce. The Bhagatha and Gadaba practice wet cultivation (terrace cultivation) with excellent water resource management techniques.

The techno-economies of the tribal groups and rural communities pursuing these economies do project

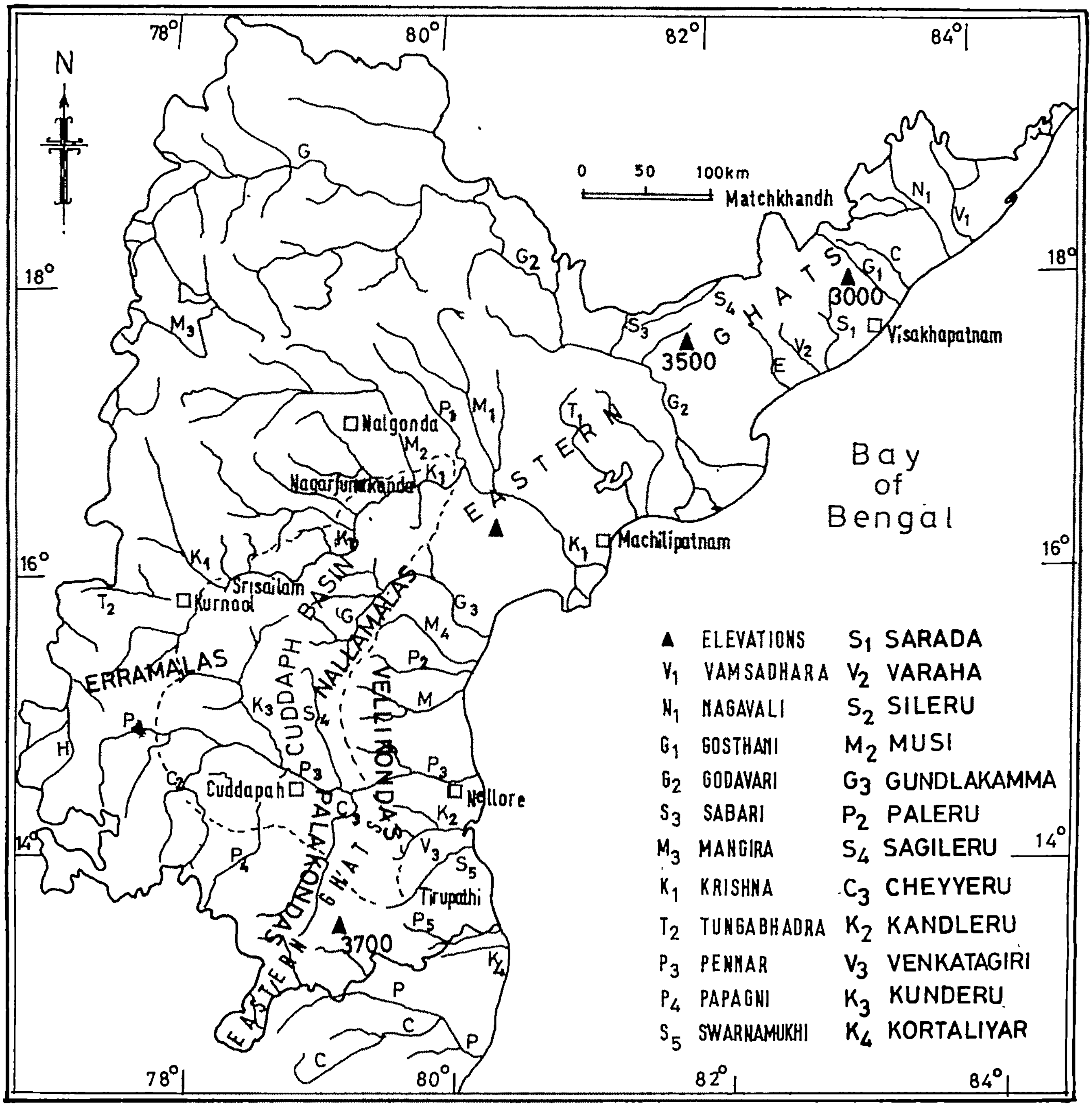

Fig. 1: Drainage Basins of Eastern Ghats in A.P.

different socio-economic levels and technologies. In the Indian context there are several anthropological studies, present different levels of technologies, economies and socio cultural practices of people. Tribal India, rural India and urban India are a mosaic of such a picture. My observations in the Eastern Ghats region fall within the anthropological perception of Indian society.

Whenever I am in the tribal habitat for fieldwork, I take the opportunity to narrate to the tribal school children the story of Man and Society and specially the cultural evolution. After the narration of the story of the man to the tribal children in a school, in Araku valley (Eastern Ghats in Visakhapatnam District) when I questioned their position in the culture history 'Neolithic' was the spontaneous answer from children as their subsistence economy is based on shifting cultivation, gathering of wild forest food resources, occasional small game hunting, and collection and sale of minor forest produce. For the same narration at an orientation programme for untrained Chenchu teachers at Srisailam (*Nallamalais* of the Eastern Ghats), the Chenchus opined that they represent Palaeolithic culture. For, till a decade back in the Srisailam plateau the subsistence economy was based on wild forest food resource to the extent of 60% of their food intake. Gathering of plant food, game hunting, simple technology are the features of the Chenchus. Anthropologists refer to the Chenchu as gatherers/foragers and hunters reflecting Stone Age economy. We had also occasions to interact with the pastorals — Kurubas and Gollas, who gather around Srisailam during festive days.

Srisailam plateau was inhabited by Middle Palaeolithic and early Upper Palaeolithic people. The Chenchu a primitive tribal group, find a mention in Manusmriti and early literary sources. A vivid description is given by Palkuriki Somanatha of 12th century A.D. in his *Panditharadhya Charitham.* They are depicted on the Srisaila temple *prakara* as hunters and gatherers. Broad leaves around their waist constitute their clothing. Bow and arrow were their weapons. Women also participated in hunting and gathering. This description is also recorded by a chronicler of 17th century accompanying the armies of Aurangzeb and later records of 19th century. In brief the Chenchus have inhabited the plateau in particular and Nallamalis in general at least during the historical period.

A wide variety of wild forest food resource is even today appropriated by the Chenchus. The resource includes game fauna of 20 important species such as spotted deer, sambar, black buck, sinkara, jungle sheep, wild boar, porcupine, wild dog and hares besides wild fowls and peafowls. The plant food resource comprises 41 varieties of wild fruits, 14 varieties of roots, tubers and bulbs, 8 varieties of nuts, 15 varieties of green leaves and 4 varieties of flowers. Honey is abundantly harvested (Reddy *et al.* unpublished survey report).

This description of food resources shows that the *Nallamalis* in general and Srisailam plateau in particular would have ensured food security to the inhabitants of the Middle Palaeolithic and Upper Palaeolithic periods. Since then the only technological change one notices is the introduction of iron for arrowheads and cutting knife. Therefore, it can be said that cultural evolution with a sequence of predetermined stages has not taken place in Srisailam plateau and that culture development has been at very slow pace, almost stagnant till iron was introduced. If this has not been the case, the other explanation would be that the Chenchus might have migrated from the peripheries with iron technology since the plateau offered them food security. The second observation is not sound since Mesolithic and Neolithic evidence found even scantly at the peripheries of the *Nallamalis*, concentration of microliths and extensive rock art depicting a variety of animals and human activity in the more open limestone area might have been introduced into the plateau if there was a migration from the peripheries at that point of time into the plateau. The survey has also revealed from the dispersal of Middle and Upper Palaeolithic artefact scatters/concentration that there was aggregation of people during dry seasons, even as today, near perennial water sources like springs and water holes and wet season dispersal to areas of other water sources such as hill streams.

On the contrary, the Patala and Machkund valleys which have presented only Mesolithic evidence and are inhabited by tribal groups such as Nookadora, Kondadora, Poroja, Khond and Kotia, who fall in the description of different levels of techno economies may perhaps offer some explanation. An inventory of forest resource appropriation not only for subsistence but also for other activities as well has been made. Except for a few iron implements all otherarchaeological things including several household artefacts and agricultural implements, are forest based. A symbiotic relationship between culture and environment is established (Mouli 1998). A few tribal communities such as Gadaba, Valmiki and Savara practise Megalithism.

Observations

The field based primary studies right from Bruce Foote to the present day, within and along the Eastern Ghats of Andhra Pradesh have presented dual systems of cultural advancement and adaptations during the prehistoric period. The hill tracts south and north of the Godavari River on the east coast of India form into two geoecological systems and presented dualism, the Palaeolithic and hill tract environments in the south, Mesolithic-Neolithic and coastal plains environments in the north.

The southern zone Eastern Ghats and their subsystems such as *Nallamalai*, *Seshachalam*, *Velikonda* and Erramalai hill ranges and their respective peripheral environments on one hand, and the Srisailam and Mannanur plateau on the other have presented an excellent database for the origin and development of Palaeolithic cultures (Appendix 1). Between these two subsystems, the hill tract environments with an average altitude of 300 m, seem to have been the centres of cultural advancements among the Palaeolithic entities, from pebble to handaxe, crudehand axe to Acheulian handaxe, broad flake to small flake, and small flake to blade. Change 1) from pebble tool to handaxe is prominently seen in the Cuddapah basin, 2) from handaxe to Acheulian type in Seshachalam and Velikonda hill ranges, 3) from Acheulian hand axe to flake tool element in the Nallamalai hill ranges and adjoining Mannanur plateau, and 4) from flake element to blade element in the narrow valleys formed and draining toward east of Nallamalai. The Srisailam and Mannanur plateaus with their dry deciduous forest environments seem to have been standby environments, whenever a resource crunch or readjustments to the changing technologies were arising. The plateaus therefore have pulled some populations at various intervals of prehistoric cultural development, but did not contribute to any inventory for the growth of culture. The geo-bioligical capacity of these plateaus sustained simple cultures with simple technologies over the ages and has been habitat of the Chenchus.

The north zone Eastern Ghats towards the coast of Bay of Bengal present three distinct geo-environments, the coastal, the peniplains and hill tracts. The coastal sites have a bearing on the geo-archaeological studies to understand the palaeo-climates at local level and also at global level. The peniplain environment of this region has played a vital role in the growth of Mesolithic culture, and Neolithic out of Mesolithic culture (Appendix 2). Here the hill tracts, like the plateaus in the south zone, have acted as standby or absorbing environments when the Mesolithic and Neolithic was emerging from the Mesolithic. The peniplains geographic extent in this part of the area is minimal to the extent that the land resource for the Neolithic cultural development rather pushed the Mesolithic into hill tracts when the tracts were capable of extending ecology for sustaining Mesolithic culture, and since then the Mesolithic remained as it was. Subsequent episodes of migration from the peniplains have resulted in the transformation of Mesolithic into simple, ecofriendly tribal cultures.

In the light of the rich prehistoric evidence and tribal ethnography including the primitive tribal groups in the Eastern Ghats only an in-depth re-examination of the data or further study of the potential sites will throw more light on the man-land relationship at micro level and culture development at the regional level, and contribute to the anthropological knowledge of cultural evolution in a pan-Indian situation. This observation on the need to restudy the data or further excavation of potential sites to generate wide range of data in other geo environments of the Indian sub-continent will go a long way in the direction of enhancing Indian theoretical archaeology.

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Appendix 1: Location aspects of Palaeolithic, Mesolithic and Neolithic Sites in the State of Andhra Pradesh:

Name of the site	Political division	*River/Stream	Nature of the site	**Context of the site	Significance of the site
Adavirajupalem	Nellore	Peddpavani. S	Surface	LP	-
Adupur	Cuddapah	Cheyyeru. S	Surface	LP-MP	-
Agraharam	Prakasam	Paleru. R	Surface	LP	-
Agraharam	Nellore	Venkatagiri. R	Stratified	LP	-
Akavedu	Kurnool	Gundlakamma.R	Surface	LP-MP	-
Akkammakonda	Anantapur	Vrdavati. S	Stratified	Neo.	-
Akkarampalle	Kurnool	Kunderu. R	Surface	LP	-
Akkurti	Chittoor	Yarlapudi. S	Stratified	LP	-
Allagedda	Kurnool	Kunderu. R	Surface	LP	-
Aluru	Kurnool	Kunderu. R	Surface	LP	-
Ambapuram	Nellore	Venkatagiri. R	Surface	LP-MP	-
Ammacheruvu	Chittoor	Yarlapudi. S	Stratified	LP	-
Anjanadri	Chittoor	Seshachalam hill ranges	Surface	LP	-
Asifabad	Adilabad	Peddavagu. S	Stratified	LP-MP	-
Basar	Adilabad	Penganga. R	-	LP-MP-UP-Meso	-
Bastipadu	Kurnool	Hindri. R	Surface	Neo.	-
Billasurgam	Kurnnol	Limestone caves	Stratified	UP	Bone Tools
Biradavada	Chittoor	Granites	Surface	LP	-
Biradavada	Nellore	Granite zone	Surface	LP	-
Boath	Adilabad	Pochra. R	Surface	LP-MP	-
Bogasamudram	Ananthapur	Buggavanka. S	Surface	LP- MP -Meso	-
Bopataiahkonda	Chittoor	Hill slopes	Surface	LP	-
Boyapalli	Cuddapah	Sagileru. R	Surface	LP	-
Burhampur	Nalgonda	Dindi. R	Surface	LP	-
Burjugundal	Mahbubnagar	Plateau	Surface	LP-MP	-
Chagalamarri	Kurnool	Kunderu. R	Surface	LP	-
Chandragiri	Chittoor	Swarnamukhi. R	Surface	LP- MP- Meso	-
Chandraguptapattanam	Mahbubnagar	Plateau	Surface	LP-MP	-
Chillakuru	Chittoor	Laterites	Surface	LP	-
Chillakuru	Chittore	Laterites	Surface	LP	-
Chinnamaruru	Mahbubnagar	Plateau	Surface	Neo.	-
Chinnayyapalle	Cuddapah	Mulavanka. S	Surface	LP-MP	-
Chintalapalem	Nellore	Peddpavani. S	Surface	LP	-
Chintarampalli	Cuddapah	Sagileru. R	Surface	LP	-
Chintrampalle	Cuddapah	Mulavanka. S	Surface	LP-MP	-
Chiratanur	Nellore	-	Surface	LP	-
Chittathur	Chittoor	Nagari hills Kalangi. R	Surface	LP	Forested Environs
Cuddapah	Cuddapah	Buggavanka.S	Surface	LP-MP	-
Dappalli	Cuddapah	Milavaram project	Surface	LP-MP- Meso	-
Deguvametta	Cuddapah	Sagileru Valley	Surface	LP-MP	-
Deguvapalli	Cuddapah	Milavaram project	Surface	LP-MP-Meso	-
Diguvapalli	Cuddapah	Bahuda. R	Surface	LP-MP	-
Dindi	Nalgonda	Dindi. R	Surface	LP-MP	-
Dornala	Guntur	Thegaleru. S	Surface	Series- I & II	-
Galeru valley	Kurnool	Kunderu. R	Surface	LP	-
Gangalapudi	Chittoor	Yarlapudi. S	Surface	LP	-
Giddaluru	Prakasam	Sagileru. R	River bed	LP	-

Godugunuru	Cuddapah	Bahuda. R	Surface	LP	-
Gollapalli	Prakasam	Duvvali. S	Terrace	Series- I & II	-
Gudali	Nellore	Granite zone	Surface	LP	-
Gudimallam	Chittoor	Sitakaluva. S	River bed	LP	Diminishing hand axes
Guravarajupalle	Chittoor	Swarnamukhi. R	Surface	LP	-
Halia	Nalgonda	Halia. R	Surface	LP	-
Hulikallu	Anantapur	Vedavati. S	Stratified	Neo.	-
Inukurthi	Nellore	Kandleru. R	Terrace-1	LP-MP	-
Iraladinne	Mahbubnagar	Srisailam Plateau	Surface	LP-MP	-
Isakathagili	Chittore	Laterites	Surface	LP	-
Itlampalli	Anantapur	Vedavati. S	Stratified	Neo.	-
Jillelapadu	Prakasam	Paleru. R	Surface	LP	-
Jinkalametta	Chittoor	-	-	LP-Meso	-
Jokandiga	Chittoor	Swarnamukhi. R	Stratified (5 layers)	LP	-
Kakunuru	Kurnool	Galeru. S	Surface	LP-MP	-
Kalahasti	Chittore	Laterites	Surface	LP	-
Kalasapadu	Cuddapah	Mulavanka. S	Surface	LP-MP	-
Kalchedu	Nellore	Kandleru. R	Surface	LP	-
Kamparthi	Cuddapah	Pennar. R	Stratified	LP	-
Kanigiri	Prakasam	Paleru. R	Surface	LP-MP-UP	-
Karapakala	Mahbubnagar	Plateau	Surface	Neo.	-
Karmpudi	Guntur	Naguleru. S	Section	LP-MP	-
Kasturivaripalle	Cuddapah	Gunjana. R	Surface	LP	Transient camp
Katamadevunikonda	Anantapur	Penneru. S	Stratified	Neo.	-
Katretipalli	Prakasam	Paleru. R	Surface	LP	-
Koilkuntla	Kurnool	Kunderu. R	Surface	LP	-
Komatigunta	Chittoor	Swarnamukhi R	Stratified (5 layers)	LP-MP	-
Kondapeta	Cuddapah	Pennar. R	Stratified	LP-MP	-
Kothakandriga	Chittoor	Nagari hills	Stratified (4 layers)	LP-MP	-
Kottapalem	Chittoor	Putturu & Velikonda hills	Surface	LP	-
Krishnapur	Nalgonda	-	Surface	LP	-
Krishnapuram	Kurnool	Bhavanasi. R	Terrace	Series- I & II	-
Kudavali	Mahbubnagar	Plateau	Surface	Neo.	-
Kuttaipalli	Cuddapah	Sagileru. R	Surface	LP	-
Kyaturu	Mahbubnagar	Srisailam Plateau	Surface	LP-MP	-
Lankalapalem	Visakhapatnam	Laterites	Surface	LP-MP-Meso	-
Madigallu	Anantapur	Penneru. S	Stratified	Neo.	-
Malapuram	Anantapur	Hagari. R	Stratified	Neo.	-
Mallemarpuram	Cuddapah	Gunjana. R	Surface	LP	-
Manchineellagunta	Chittoor	Nagari hills	Open air site	LP	-
Manulapeta	Chittoor	On road side	Stratified (5 layers)	LP-MP	-
Masireddipalli	Cuddapah	Kincha. R	Surface	LP	On large flakes
Medimankal	Mahbubnagar	Plateau	Surface	LP-MP	-
Meenampalli	Nalgonda	Peddavagu. S	Surface	LP-MP	-
Menskura	Nellore	Granite zone	Surface	LP	-
Merlapaka	Chittoor	-	Stratified	LP	-
Mitnala	Kurnool	Kunderu. R	Surface	LP	-
Mittakandiga	Chittoor	Mittakandriga Reservoir (4 sect)	-	PL-Meso	-
Muchukota	Ananthapur	Buggavanka. S	Surface	LP- MP -Meso	-

Muddanuru	Cuddapah	Sagileru valley	Surface	LP-MP	MP artifacts on chert
Mushturu	Anantapur	Chitravati. S	Stratified	Neo.	-
Mydakuru	Cuddapah	Bahuda. R	Surface	LP	Pits
Nagarjunakonda	Guntur	Krishna. R	Terrace	LP-MP	-
Nagarjunakonda	Guntur	Krishna. R	Surface	LP	-
Nagarjunakonda	Guntur	Krishna. R	River bank	LP-MP	-
Nagpur	Adilabad	-	-	LP-MP	-
Nalugukallamantapa	Chittoor	Oddolla cheruvu	Stratified (5 layers)	LP	-
Nandaluru	Cuddapah	Cheyyeru. R	Terrace	LP	-
Nandavaram	Kurnool	Kunderu. R	Surface	LP	-
Nandipalli	Cuddapah	Mulavanka. S	Stratified	LP-MP	-
Narayananellore	Cuddapah	Gunjana. R	Surface	LP	Base-cum-work camp
Narthimanukandriga	Chittoor	Swarnamukhi. R	Stratified (5 layers)	LP-MP	-
Nethivaripalle	Cuddapah	Gunjana. R	Surface	LP	Base-cum-work camp
Nittamedikandrika	Chittoor	Sitakaluva. S	River bed	LP	-
Parlapalli	Chittoor	Swarnamukhi. R	Surface	LP	-
Palavoi	Anantapur	Penneru. S	Stratified	Neo.	-
Pathagunta	Chittoor	Yarlapudi. S	Surface	LP	-
Patpadu	Kurnool	Kunderu. S	Stratified	Neo.	-
Peddavalapadu	Prakasam	Paleru. R	Stratified	LP	-
Penubarthi	Nellore	Kandleru. R	Stratified	LP-MP	-
Prodduturu	Cuddapah	Kunderu. R	Stratified	LP-MP	-
Ramagiri	Cuddapah	Pennar. R	Surface	LP	-
Ramapuram	Kurnool	Kunderu. S	Stratified	Neo.	-
Ramayogi-agraharam	Visakhapatnam	Coast	Stratified	LP-MP-UP-Meso	-
Rayavaram	Nalgonda	Peddavagu. S	Surface	LP-MP	-
Reddivaripalle	Cuddapah	Mandavi. S	Surface	LP-MP	-
Rosanuru	Nellore	Granite zone	Surface	LP	-
Rushikonda	Visakhapatnam	Maddigadda. S	Stratified	LP-MP-UP	-
Sakirala	Prakasam	Paleru. R	Surface	LP	-
Sambayyapalem	Chittoor	Swarnamukhi. R	Stratified (4 layers)	LP	-
Sanambatla	Chittoor	Swarnamukhi. R	Surface	LP	-
Siddareddipalli	Cuddapah	Gunjana. R	Surface	LP	-
Siddavatam	Cuddapah	Pennar. R	Stratified	LP	-
Sillavaripalli	Cuddapah	-	Surface	LP	-
Singanapalli	Kurnool	Kunderu. S	Stratified	Neo.	-
Singarayakonda	Prakasam	Manneru. S	Surface	LP-MP	-
Singavaram	Mahbubnagar	Tungabhadra. R	Surface	LP-MP	-
Sirsanambedu	Chittoor	Swarnamukhi. R	-	LP-MP-UP	-
Sivasankarapuram	Chittoor	Foot hills	Surface	LP-MP	-
Somsila	Mahbubnagar	Srisailam Plateau	Surface	LP	-
Sripuram	Nellore	Peddpavani. S	Surface	LP	-
Srisailam	Kurnool	Plateau	Surface	LP-MP-UP	-
Tadipatri	Anantapur	Penneru. R	Stratified	Neo.	-
Tandrepadu	Kurnool	Tungabhadra. R	Terrace	Series- I & II	-
Thamballapalle	Cuddapah	Gundleru. R	Stratified	LP-MP	-
Thammanenipalle	Prakasam	Paleru. R	Surface	LP	-
Thammanenipalle	Prakasam	Paleru. R	Surface	LP-MP	-

Thikkalathuru	Chittoor	Swarnamukhi. R	Surface	LP	-
Thimmachettapalli	Cuddapah	Gunjana. R	Surface	LP	-
Tottembedu	Chittoor	Swarnamukhi. R	Surface	LP	-
Ummadivaram	Kurnool	Kunderu. R	Terrace	Series- I & II	-
Utnur	Mahbubnagar	Tungabhadra. R	Stratified	Neo.	-
V. Venkatapuram	Chittoor	Yarlapudi. S	Surface	LP	-
Vaddamanipalle	Cuddapah	Gundleru. R	Stratified	LP-MP	-
Vaddamanu	Cuddapah	Bokkineru. S	Stratified	LP	Three localities
Vaddivarikandriga	Chittoor	Yarlapudi. S	Stratified (4 layers)	LP	-
Vallavaram	Prakasam	Paleru. R	Surface	LP	-
Veerapuram	Kurnool	Plateau	Surface	Neo.	-
Venkatagiri	Nellore	Venkatagiri. R	Stratified	LP	-
Venkatarajupalle	Cuddapah	Gunjana. R	Surface	LP	-
Wizirabad	Nalgonda	Musi. R	Stratified	LP-MP	-
Yarlapudikaluva	Chittoor	Yarlapudi. S	River bed	LP	-
Yatakal North West	Anantapur	Penneru. S	Stratified	Neo.	-
Yeleswaram	Nalgonda	Peddavagu. S	Surface	LP	-
Yerragondapalem	Prakasam	Rallavagu. S	Surface	LP-MP-UP	-

* R: River, S: Stream.

** PL: Palaeolithic, LP: Lower Palaeolithic, MP: Middle Palaeolithic, UP: Upper Palaeolithic, Meso: Mesolithic, Neo.: Neolithic.

- Information not available.

The data presented in this table is mostly drawn from M.Phil Dissertation of one of my former students, Miss. Mercy Rani, Telugu University, Srisailam Campus.

Appendix 2: Site-wise distribution of Mesolithic sites in different geo-ecological zones of northeastern part of Andhra Pradesh

Name of the site (After nearby village name)	Catchment area River/Stream/ Sea coast	Nature of the site	Cultures represented LP/MP/UP/Meso./ Neo./Meg.*
Addakulaguda	Ngavali. R	Foot hill	Meso.
Addatigala	Eleru. R	Stream bank	UP. Meso.
Adugulaputtu	Machkund. R	Hill top	Meso.
Aminabad	Donigedda. H.S	Stream bank	UP. Meso.
Andra	Champavathi. R	Stream bank	Meso. Neo.
Antarla	Tajangigedda. H.S	Foot hill	Meso.
Appannapalem	Eleru. R	Stream bank	Up. Meso.
Appayyapeta	Suvarnamukhi. R	Foot hill	Meso.
Aradugudem	Reyyalagedda. H.S	Hill top	Meso.
Artam	Nagavali. R	Foot hill	Meso.
Babusala	Vasagummiguda.H.S	Cave	Meso
Bangarumetta	Machkund. R	Foot hill	Meso.
Bangaruputtu	Machkund. R	Rock Shelter	Meso.
Banjaripeta	Garibulagedda. H.S	Foot hill	Meso .Neo.
Bhalluguda	Chinnagedda. H.S	Foot hill	Meso.
Bhimunipatnam	Sea Coast	Bad lands	Meso. Neo.
Boddaputtu	Dippa/Bongagedda. H.S.	Foot hill	Meso.
Bodiguda	Patala. R	Rock-shelter	Meso.
Bodiput	Sarasalgedda. H.S	Hill top	Meso.
Bokkeddlu	Machkund. R	Hill top	Meso.
Boramanuguda	Dippa/Bongagedda. H.S.	Hill top	Meso.
Boredupalem	Gambheeram. R	Stream bank	Meso. Neo.
Bottadivalasa	Vegavathi. R	Foot hill	Meso. Neo.
Bournagudem	Donigedda. H.S	Stream bank	UP. Meso.
Boyapalem	Gambheeram. R	Stream bank	MP. Meso.
Buragaputtu	Reyyalagedda. H.S.	Foot hill	Meso.
Busiputtu	Machkund. R.	Hill top	Meso.
Chellivalasa	Vegavati. R	Foot hill	Meso.
Chilakalagedda	Chilakalagedda. H.S	Stream bank	Meso. Neo.
Chinaichapuram	Gosthani. R	Stream bank	Meso.
Chinapaipalli	Gedigedda. HS, Machkund	Hill top	Meso.
Chintalaagraharam	Gosthani. R	Stream bank	Meso.
Chintalavidi	Dippa/Bongagedda. H.S	Foot hill	Meso.
Chintalavidi	Chilakalamamidigedda.H.S	Hill top	Meso.
Chittigaruvu	Reyyalagedda. H.S.	Foot hill	Meso.
Dasarsdhiguda	Vamsadhara. R	Foot hill	Meso. Neo.
Devarapalli	Sarada. R	Stream bank	Meso.
Dibbalapalem	Local Hill stream	Foot hill	Meso. Neo.
Dukkavanipalem	Gambheeram. R	Foot hill	Meso.
Dummaputtu	Machkund. R.	Foot hill	Meso.
Eleswaram	Eleru. R	River terrace	UP. Meso.
Ellavaram	Eleru. R	Stream bank	UP. Meso.
Gaddivalasa	Machkund. R.	Hill top	Meso.
Gambheeram	Gambheeram. R	Stream bank	Meso. Neo.
Getuvalasa	Gosthani. R.	Rock-Shelter	Meso.
GITAM	Sea Coast	Bad lands	MP. Meso.
Godlapadu	Machkund. R.	Foot hill	Meso.

Gondili	Machkund. R.	Hill top	Meso.
Gucchimi	Suvarnamukhi. R	Foot hill	Meso. Neo.
Gudilova	Gambheeram. R	Stream bank	MP.UP. Meso. Neo
INS Kalinga	Sea coast	Bad lands	MP. Meso. Neo.
Ippamanuguda	Vamsadhara. R	Foot hill	Meso. Neo.
Iradapalli	Machkund. R.	Rock-shelter	Meso.
Isakagaruvu	Dippa/Bongagedda. H.S	Foot hill	Meso.
Jallipalle	Machkund. R.	Hill top	Meso.
Jeddangi	Madieru. H.S	Stream bank	UP. Meso.
Jogulaputtu	Machkund. R	Foot hill	Meso.
Kangaruputtu	Machkund. R	Hill top	Meso.
Karakaputtu	Machkund. R.	Hill top	Meso.
Kasimkota	Sarada. R	Stream bank	Meso. Neo.
Kasipatnam	Gosthani. R.	Stream bank	Meso. Neo.
Kimudipalli	Gedegedda.HS, Machkund	Foot hill	Meso.
Kinchuri	Machkund. R	Foot hill	Meso.
Kinerla	Tajangi. H.S	Rock-shelter	Meso.
Kittingivalasa	Andarvagu. H.S	Foot hill	Meso.
Koduru	Local Hill stream	Foot hill	LP. Meso.
Kolasinga	Mahendratanaya. R	Stream bank	Meso.
Kolaturu	Donigedda. H.S	Stream bank	UP. Meso.
Komarada	Nagavali. R	Stream bank	Meso.
Kontili	Dippa/Bongagedda. H.S	Hill top	Meso.
Kopparavalasa	Nagavali. R	Hill top	Meso.
Kotanapalli	Mundigedda. H.S	Stream bank	Meso.
Kothavalasa	Machkund. R.	Foot hill	Meso.
Kotnasapalli	Mundigedda. H.S.	Hill top	Meso.
Kottapaderu	Dippa/Bongagedda.H.S.	Hill top	Meso.
Kotturu	Machkund. R	Hill top	Meso.
Krishnavaram	Eleru. R	Stream bank	UP. Meso.
Kttavelagada	Gosthani. R	Stream bank	Meso.
Kulapadu	Dippa/Bongagedda. H.S	Foot hill	Meso.
Kumaraputtu	Dippa/Bongagedda.H.S.	Hill top	Meso.
Kurumpeta	Nagavali. R	Stream bank	Meso.
Labbangi	Tajangi. H.S	Stream bank	Meso.
Lankalapalem	Local hill stream	Foot hill	LP. MP. Meso.
Lingaputtu	Machkund. R	Foot hill	Meso.
Lingavaram	Eleru. R	Stream bank	UP. Meso.
Machchapuram	Vasagummiguda. H.S	Hill top	Meso.
Maddirayudupeta	Nagavali. R	Foot hill	Meso.
Madhurawada	Peddagedda. H.S	Stream bank	MP. Meso. Neo. Meg
Madhyakadamam	Gambheeram. R	Stream bank	UP. Meso. Neo.
Madigunta	Tajangi. H.S	Stream bank	Meso.
Mallavaram	Madieru. H.S	Stream bank	Meso.
Mamidilova	Yerrakaluva. H.S	Stream bank	Meso. Neo.
Mangalipalem	Local hill stream	Foot hill	MP. Meso.
Marikavalasa	Peddagedda. H.S	Stream bank	UP. Meso. Neo.
Marripalem	Local hill stream	Foot hill	Meso.
Mattam	Machkund. R.	Rock-shelter	Meso.
Mondikota	Reyyalagedda. H.S	Foot hill	Meso.
Mullumetta	Dippa/Bongagedda. H.S	Hill top	Meso.
Munchngiputtu	Dippa/Bongagedda. H.S	Hill top	Meso.
Musalavada	Local hill stream	Foot hill	Meso. Neo.
Musidiputtu	Machkund. R	Hill top	Meso.
Nadimividi	Dippa/Bongagedda. H.S	Foot hill	Meso.

Nakkalaputtu	Dippa/Bongagedda. H.S	Hill top	Meso.
Narapadu	Local hill stream	Foot hill	Meso.
Nayuduguda	Vamsadhara. R	Stream bank	Meso.
Nimmalapadu	Buradagedda. H.S	Foot hill	Meso.
Nimmalapalem	Maddigedda. H.S	Foot hill	Meso.
Padmanabham	Gosthani. R.	Stream bank	Meso. Neo.
Paipalle	Machkund. R.	Hill top	Meso.
Pakalu	Donigedda. H.S	Stream bank	UP. Meso.
Pandavulametta	Nagavali. R	Hill top	Meso. Meg.
Pappalavanipalem	Gambheeram. R	Foot hill	Meso. Neo.
Patrangini	Chinnagedda. H.S	Hill top	Meso.
Patruda	Vasagummiguda. H.S	Hill top	Meso.
Peddabarada	Tajangi. H.S	Hill top	Meso.
Peddagarivi	Mundigedda. H.S	Foot hill	Meso.
Peravaram	Donigedda. H.S	Stream bank	UP. Meso.
Potinamallayyapalem	Peddagedda. H.S	Stream bank	LP. Meso. Neo.
Ramayogiagraharam	Sea Coast	Bad lands	MP.UP. Meso.
Raba	Champavathi. R	Stream bank	Meso.
Rajavommangi	Madieru. H.S	Stream bank	UP. Meso.
Rakasirai	Dippa/Bongagedda. H.S	Hill top	Meso.
Ramachandrapuram	Mahendratanaya. R	Stream bank	Meso.
Ramanayyapeta	Donigedda. H.S	Stream bank	Meso.
Rangasila	Andarvagu. H.S	Rock-shelter	Meso.
Ravivalasa	Nagavali. R	Stream bank	Meso. Neo.
Rentada	Tajangigedda. H.S	Hill top	Meso.
Revidi	Gosthani. R	Stream bank	Meso.
Rompalli	Champavathi. R	Stream bank	Meso.
Rudakota	Vasagummiguda. H.S	Hill top	Meso.
Rupabadra	Vamsadhara. R	Stream bank	Meso. Neo.
Rushikonda	Sea coast	Stream bank	LP. UP. Meso.
Sabbupalem	Sarada. R.	Stream bank	Meso.
Sandraputtu	Dippa/Bongagedda. H.S	Foot hill	Meso.
Saravanipalem	Local hill stream	Foot hill	Meso.
Sariyapalli	Vasagummiguda. H.S	Hill top	Meso.
Satraiputtu	Dippa/Bongagedda. H.S	Foot hill	Meso.
Sattinaguda	Vamsadhara. R	Stream bank	Meso.
Shikari	Machkund. R	Hill top	Meso.
Sidiputtu	Machkund. R	Hill top	Meso.
Siripur	Mahendratanaya. R	Stream bank	Meso. Neo.
Siripuram	Tajangi. H.S	Stream bank	Meso.
Sontyam	Yerrakaluva. H.S	Stream bank	UP. Meso. Neo.
Sunduruputtu	Chilakalamamidigedda.H.S	Hill top	Meso.
Tajangi	Tajangi. R	Hill top	Meso.
Tantalgarh	Machkund. R	Foot hill	Meso.
Tarnarda	Machkund. R	Foot hill	Meso.
Tatipudi	Gosthani. R	Stream bank	Meso.
Thadiputtu	Dippa/Bongagedda. H.S	Hill top	Meso.
Tigalavalasa	Machkund. R	Foot hill	Meso.
Timmapuram	Eleru. R	Stream bank	UP. Meso.
Tulbarangi	Machkund. R	Hill top	Meso.
Turaimetta	Machkund. R	Foot hill	Meso.
Urlakulapadu	Donigedda. H.S, Eleru. R	Foot hill	UP. Meso.
Vadapalem	Sea coast	Stream bank	Meso.
Vangasari	Tajangi. H.S	Cave	Meso.
Vattigedda	Madieru. H.S	Foot hill	Meso.

Velapalem	Machkund. R.	Hill top	Meso.
Vemagiri	Godavari. R. (Left bank)	Hill top	Meso. Neo. Meg.
Venkatarajupuram	Sarada. R.	Stream bank	UP. Meso.
Vetamamidi	Maddigedda. H.S.	Foot hill	Meso.

H.S = Hill Stream. R. River
*LP. Lower Palaeolithic, MP. Middle Palaeolithic; UP. Upper Palaeolithic;
Meso. Mesolithic; Neo. Neolithic; Meg. Megalithic

The data presented in this table is drawn from the manuscript prepared by Prof. P. Vijaya Prakash, Department of Anthropology, Andhra University, Visakhapatnam, for publication.

Green Imperialism: Monsoon in Antiquity and Human Response[1]

M.K. Dhavalikar

Srivatsa, 33 Navketan Society
Kothrud
Pune 411 037

I must express my grateful thanks to the authorities of the Indian Society for Prehistoric and Quaternary Studies for inviting me to deliver this year's Professor H.D. Sankalia Memorial lecture. The late Professor Sankalia was my *Guru*, and I am therefore indeed very happy to pay my tribute to his memory through this lecture. Dr. Sankalia was a pioneer in many ways and it was he who introduced Environmental Archaeology at Deccan College, Pune whose contribution is well known.

I

The role of environment in human life is now increasingly being recognized. The whole world is worried about our deteriorating environment, and if remedial measures are not taken on war footing, the very existence of all life – human, plant and animal – will be endangered in the 21st century. A very gloomy picture is being painted with doomsday fast approaching. If this is the situation in the 21st century when technology has immensely advanced, one can imagine what must have happened in the ancient past when man had to cope with nature with his primitive technology. He had no option but to adapt to the environment or else he would not have survived.

The importance of environment in human cultures was first recognized by Gordon V. Childe (1928) who developed what can now be called an ecological model to explain the transition from hunting-gathering to food production which led to settled life for the early man. Parallel developments were taking place in the realm of history by the *Annales* school of France which was founded in the forties by Lucien Febvre and Marc Bloch and flourished under its most ardent advocate, Fernand Braudel. For him, the history of man is nothing but the history of his relationship with the environment, which is a great constraint in the development of human cultures. This is no doubt tantamount to environmental determinism.

> The environment is a hindrance beyond which man and his experiences cannot go... For centuries man has been a prisoner of climate, of the animal population, of a particular agriculture, of a whole slowly established balance from which he cannot escape without the risk of everything being upset. (Braudel 1980: 30)

Braudel's approach has long been neglected by archaeologists, but of late is slowly gaining attention (Knapp 1992). Archaeologists have now realized the importance of environment and the new sub-discipline of 'Environmental Archaeology' is well established for understanding the relationship between culture and environment. (O'Connor 1998). It has made rapid strides in the western world, but in India it is still in the nascent stage. The only institutes where some work on the reconstruction of past environment is being done are the Deccan College, Pune where the beginning was made by Sankalia, and his colleagues, and Physical Research Laboratory, Ahmedabad by D.P. Agrawal. Gurdip Singh's (1971) palynological work in Rajasthan deserves a special mention in this respect.

It is now generally agreed that there have been drastic changes in climate from the time of early man and it is these changes that were largely responsible for shifts in culture through time. This synchronism has been noted by Wendland and Bryson (1974), leading palaeo-climalists who collected and analyzed some 3,700 radiocarbon dates and studied those associated with culture changes. It was observed that there was a close correspondence between culture changes and environmental shifts which indicate that environment did play a significant role in culture change. Similar studies were carried out in USA and the Sahara region and they too support the conclusion that cultural changes were triggered by environmental shifts (Lamb 1982:114). Although this is now clearly established, there are a few dissenting voices objecting to this "Green imperialism" (Meggars 1954; Paddayya 1981-82), but there is clear evidence to show that early man was at the mercy of the nature who was the conditioner of his culture.

II

It will be of great interest to review the course of Indian history through an ecological perspective. India is a land of monsoon and our entire life cycle depends on the monsoon which has a considerable variability. It is rightly said that in India agriculture is a gamble with nature, for every third year is a bad year and every fourth, a famine. In spite of improved technology and scientific developments in agriculture, we know the plight of the Indian farmer. One can then only imagine what must have been the situation in the ancient past. A casual glance at our history shows that during the last five thousand years, there were only two phases of prosperity: first, during the Harappan civilization (c. 3000-2000 B.C.) and second, in the early historic period (c. 500 B.C.-500 A.D.); all the remaining phases are marked by degeneration and decay. The question that then necessarily arises is: What were the factors that caused the prosperity and decline almost in cyclical succession? Foreign invasions, cessation of trade, over-exploitation of resources and so on have been advanced as the causes of decline whereas profitable foreign trade brought prosperity. But the most important factor, environment, which was the root cause, has not been taken into consideration. This may appear to some to be ecological determinism or what is now called 'Green imperialism', but considering our total dependence on monsoon, one has to accept it.

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[1] Prof. H.D. Sankalia Memorial Lecture, delivered during the XXIX Annual Conference of the Indian Society for Prehistoric and Quaternary Studies, held at M.S. University of Baroda, 22-24 November 2001.

How do we reconstruct the monsoon rainfall in the ancient past? There are scientific methods for reconstructing past environments which include palynology, archaeozoology, dendroclimatology, geoarchaeology and so on. However, we have not collected biological material from our excavations, nor do we have trees like sequoia pines which survive for thousands of years. Moreover, these methods allow us to make broad inferences for periods lasting thousands of years, and they are not very useful for drawing conclusions about monsoon with precision. However, there is one source about which we have remained blissfully ignorant; that is Nile flood-levels.

Nile floods

It may be questioned as to what Nile floods have to do with the Indian monsoon. In this context it is pertinent to note that Egypt itself does not receive any appreciable rain, for its annual rainfall is hardly 25 mm, and in south Egypt it hardly, if ever, rains. The annual Nile floods are the direct consequence of the summer rainfall over the Blue Nile basin in the highlands of Ethiopia. North and east Africa get the same monsoon that we receive in India, and the great river is flooded. It has been observed that the monsoon fluctuations tend to occur simultaneously over large parts of Africa and India. Sir Gilbert Walker, former Director General of the Indian Meteorology department, studied rainfall data from India and Africa from 1840 to 1910 and discovered a close correspondence between the abundance of Nile floods and the monsoon rains in the northwest and Western India (Walker 1986).

> It is now fully established that years of drought in western and northwestern India are almost invariably the years of low Nile flood. The relation is further confirmed by the fact that years of heavier rain than usual in Western India are also the years of high Nile flood. (*Imperial Gazetteer* 1908: I, 127)

It is significant that in the 19th century North Africa and India experienced common intervals of droughts and in the present century both have experienced weak monsoon between the 1960s and 1970s (Kutzbach 1987: 289). Incidentally it may be mentioned that even Alexander's historians were aware of this correspondence (Arrian's *Indica*, Ch. 21-22).

It is well known that Nile flood data is available in Egypt for centuries, the earliest of which goes back to 2900 B.C. (Bell 1970). There are 63 annual flood records from the Early Dynastic (3050 B.C.-2700 B.C.) to the Old Kingdom (2700-2215 B.C.) and 28 for Middle Kingdom (2040-1715 B.C.) but no systematic data is available for the New Kingdom (1570-1070 B.C.) and the Late Dynastic (1070-322 B.C.) (Evans 1990; Butzer 1976: 28-29). However, from 622 to 1521 A.D. these data are available for almost every year (Toussoun 1925) when the flood level was recorded by a gauge – Nilometer – which was invented by an Egyptian Sultan who installed it on the island of Roda in the Nile. The data survives in the form of flood level marks, inscriptions, and marks on buildings, temples and steps leading to the river (Biswas 1970: 15).

How far are these data reliable? This can be tested by the recorded evidence in India. There is a strong tradition of twelve year famines in India. One such devastating famine, which still lingers in public memory, is the 'Durgadevi' famine which occurred between 1396 to 1408. If we check the Nile flood data for this period, we find that the Nile levels were extremely low exactly during these years (Quinn 1992). Another test is to examine as to when the twelve year famine described in the *Dasa-Kumara-Charita* occurred. Dandin, its author, is supposed to have been in the Pallava court during the reign of Parameshwarvarman I (670-700 A.D.) and Narasimhavarman II (700-728 A.D.). His description of the famine is so heart rending that one feels that the famine actually must have occurred and the author must have witnessed it. The Nile levels were extremely low during 683-696 A.D., and 770-782 A.D. and sometimes there was even snow in it. We can therefore safely conclude that the famine described by Dandin occurred during 683-696 A.D. and that it is referred to in the *Narada Purana* in 770-782 A.D.

It will be clear that the Nile flood data is extremely reliable and will go a long way in understanding the pattern of rainfall in ancient India. Since the monsoon is the most important component of our environment, as it

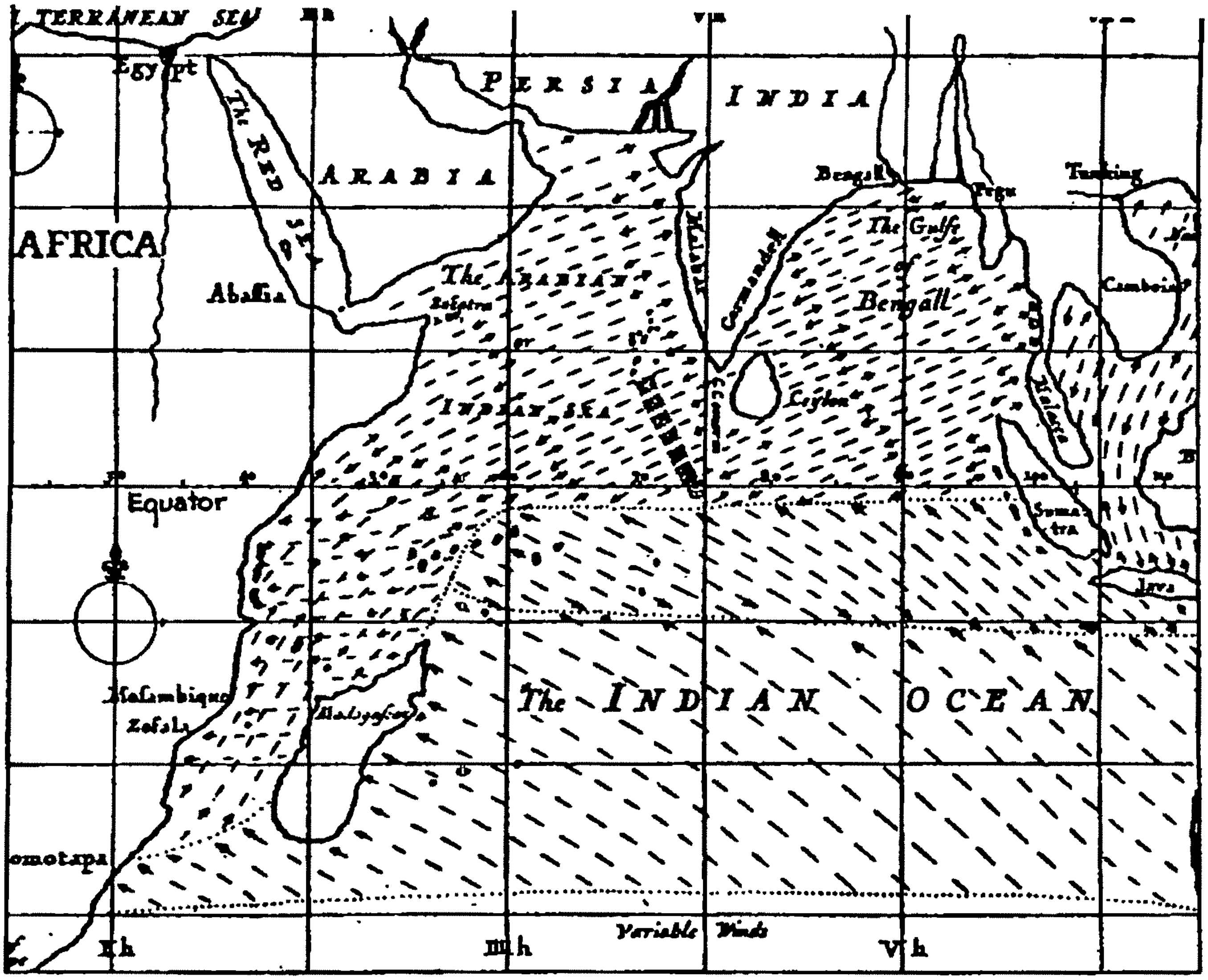

Fig. 1: The direcxtion of the southwst and northeast monsoon (after Kutzbach)

makes or mars our fortunes, it will be interesting to reconstruct the behaviour of monsoon in India for the past five thousand years, and see how far it has been responsible for the ups and downs in Indian history.

III

The Nile flood data goes back to five thousand years when great civilization sflourished in both Egypt and India. The beginning of the Harappan civilization now stretches back to c.3250 B.C. the early phase lasting up to 2600 B.C., followed by the Mature or the Urban phase (c. 2600-2000 B.C.), after which decline set in and it vanished from the scene by 1500 B.C. Over 1400 settlements of this glorious civilization have so far been reported of which over a thousand are in India and the remaining in Pakistan. Although it was first discovered in the Indus valley, it is now clear that its major focus was the Saraswati basin where there was a heavy concentration of settlements and hence some scholars would prefer the sobriquet 'Saraswati Civilization'. The numerous settlements include large and small villages, towns and metropolitan centres. It had the widest distribution of ancient civilizations and it was far more extensive than the contemporary Egyptian and Mesopotamian civilizations combined.

The opening of the third millennium marks the rise of civilizations in Mesopotamia, Egypt, Central Asia and China. One can justifiably ask as to how is it that the third millennium is marked by the emergence of civilizations all over the Old World? One feature which is common to all is the favourable environment. It has been noticed that the environment was very congenial during the Mesolithic period from 13,000-9,000 B.P. and began to change towards aridity which lasted up to 5,000 B.P. It was during this period that man was forced to produce his own food (Cohen 1977). Climate again began to change from 5000 years B.P. – or 3000 B.C. – and the entire third millennium is marked by a good rainfall in India (Ramaswami 1968). Gurdip Singh's (1971) pollen analytical studies deserve a special mention in this respect. Rajasthan is divided into two parts by the Aravalli range which runs in the northeast-southwest direction. The eastern half gets a slightly better rainfall and is semi-arid but the western region is part of the Thar desert which extends into Pakistan also. It is arid, sterile and sandy through which the Saraswati (present Ghaggar in India and Hakra in Pakistan) was flowing in ancient times, but is now completely dry. Presently the annual precipitation is hardly 100 mm, but was considerably more in the third millennium. Investigations were carried out on three salt lakes – Sambhar, Lunkaransar and Didwana and a fresh water lake, Pushkar. The palynological studies of the lake sediments revealed that the climate some ten thousand years ago (Phase I) was characterised by severe aridity whereas Phase II (8000-7500 B.C.) was marked by increased rainfall. This phase corresponds with the pre-Boreal phase of Europe when temperatures were rising throughout the Old World. Again in Phase III (7500-3000 B.C.) the rainfall decreases. This phase corresponds with the Boreal and Atlantic phases of Europe. Sedentism began during this phase in the fourth millennium as the Hakra culture sites in the Cholistan desert of Pakistan would indicate (Mughal 1997). However, Gurdip Singh (1971) is of the opinion that some form of primitive agriculture must have started much earlier in the 7th millennium which is now corroborated by the evidence from Mehrgash (Jarrige 1993).

Gurdip Singh's phase IV covers the Mature Harappan period from c. 3000-1800 B.C. (Calibrated 3200-2000 B.C.) which is characterised by a sudden shift to wetter conditions when the average rainfall may have been in the range of 600 mm (24 inches). The Saraswati was also then flowing in full force. The satellite imagery shows that it was a mighty river, 8-12 km wide at places and flowed independently into the Gulf of Kachch (Misra 1994). It is no wonder that the Harappan civilization flourished in such a favourable environment. However, Gurdip Singh's conclusions have been questioned and it has been argued that there has been no climate change during the Holocene in the last ten thousand years (Possehl 1997: 193).

The record of Nile floods in Egypt, which is scratched on the rocks overlooking the river and is available from the time of the first Dynasty (c. 3000 B.C.), also suggests a very favourable environment because of the high floods of the Nile resulting from a good rainfall in Ethiopia. We can therefore infer good monsoons also in India. There is a hint of seasonality of monsoon in the Babylonian commercial documents. Some of them refer to a voyage to Dilmun and Makan and advise merchants that in the month of February-March the wind is most favourable for sailing. This document is dated 2031 B.C. and there is another belonging to the same period which states that July-August was most suitable (Warren 1987: 139-40). Several sites in West Asia have yielded evidence of devastating floods as at Ur, Kish and Nineveh, and even the Biblical Noah's flood also belongs to this period. The climate during this phase- Atlantic- is supposed to have been warmer by 2 °C than at present (Lamb 1982: 120-21).

The Harappan civilization constitutes a most glorious chapter in Indian history. It was as old as those of Egypt and Mesopotamia but was more advanced than them in some respects. People lived in large houses in well-planned cities which had civic amenities. Mohenjodaro is said to have been the largest city of the ancient world (Jansen, 1993). Towns were divided into four sections, for the rulers, noblemen, middle class and others as the evidence from several sites shows. At Dholavira these localities had enclosure walls (Bisht 1991). What it means in terms of social organization is difficult to say, but it surely suggests the existence of a class- structured society, the forerunner of the latter day *varna* system. It may not be out of place to mention here that ancient Vaishali was also divided into four sections for the four classes and the same has been confirmed by literary evidence. (Altekar and Misra 1959).

A most important factor which made Harappans prosperous was their trade with West Asia. The evidence is furnished by cuniform documents in West Asia which show that in the Akkadian period, more particularly under Sargon I (c. 2350 B.C.), it was at its zenith (Ratnagar 1981). Three countries are mentioned in these documents. Dilmun (Bahrain), Makan (Gulf of Oman), and Meluhha. It is now generally agreed that Meluhha was India. (Leemans 1960: 159 ff). Meluhha has been explained as Meluhha > melakkha > mleçhchhạ. It may be noted that one of the meanings of the word *mlechchha* is copper, and it is highly likely that the Gujarat-Rajasthan region came to be known as Meluhha because of the rich copper deposits spread from Ambamata to Ganeshwar. What is more, copper is mentioned as one of the imports from India to Mesopotamia and hence the inscriptions mention Meluhha (Dhavalikar 1997).

Decline – Late Harappan

The prosperity of the Indus civilization lasted till the end of the third millennium after which decline set in. Formerly floods and Vedic Aryans were held responsible for the downfall of the Harappans, but considerable research and recent excavations suggest that the causes of degeneration of this great civilization were different in different regions. Floods may have caused the decline of Mohenjodaro (Raikes 1964, 1965). Tectonic movement was probably one of the causes, as it seems that there were a series of earthquakes in West Asia, and also at Dholavira, and Banawali in Rajasthan. The drying up of the Saraswati in the lower basin because of the changing of courses of the Yamuna and the Sutlej led to the large scale abandonment of sites (Raikes 1964) whereas in Gujarat Harappan post-towns like Lothal fell into disuse because of fall in sea levels (Sarma 1971). Frequent droughts in all likelihood led to the economic degeneration if evidence from sites such as Kanewal and Ratanpura is any indication (Bhan 1992; Dhavalikar 1994: 94ff).

Table 1: Nile flood record (after Butzer 1982)

Period in B.C./A.D.	Intensity
5000-4750 B.C.	low (+2)
4750-4500 B.C.	high (+6)
4500-4250 B.C.	very high (+8)
4250-4000 B.C.	high (+4)
4000-3750 B.C.	very high (+8)
3750-3500 B.C.	high (+6)
3500-3250 B.C.	low (+2)
3250-2750 B.C.	slightly high (+3)
2750-2500 B.C.	low (+2)
2500-2200 B.C.	low (+2)
2200-2000 B.C.	very low (-1)
2000-1750 B.C.	very high (+7)
1750-1500 B.C.	very high (+7)
1500-1250 B.C.	high (+6)
1250-1000 B.C.	very low (-2)
750-300 B.C	low (+1)
300 B.C.-100 A.D.	high (+4)
100-400 A.D.	high (+3)
400-700 A.D.	very low (-1)

It appears that there was drastic change in climate from the beginning of the second millennium B.C. (Gurdip Singh 1971) and the same is also supported by the evidence of Nile levels. The Nile flood data reveal that during the fourth and the third millennia the climate was favourable with good rainfall in the catchment area of the Blue Nile in Ethiopia and we can therefore infer that India also enjoyed adequate rainfall (Table 1). In Egypt there are 63 inscriptions of I-V Dynasties (3rd millennium) recording Nile levels. If seems that the level was quite low in 2850 ± 100 B.C., again in c. 1950 ± 50 B.C. (Butzer 1982: 137). Consequently there were severe famines in Egypt and the country was devastated by invaders who were probably forced to leave their homeland because of frequent droughts. The urban culture of Iran collapsed around 2100 B.C. as also in Central Asia. Increasing aridity was the main cause of the collapse of early civilizations (Shaffer and Thapar 1992: I, 464). This has been scientifically established by evidence from excavations of many Akkadian town sites in northern Mesopotamia where the abrupt climatic change has been directly linked to the collapse of a thriving civilization. (Weiss *et al.* 1993). This is not a vain boast of excavators, for Marie-Agnes Courty, a scientist attached to the excavation team, analysed soil layers from Teil Leihan and found that the climate became severely arid from 2200 B.C. and remained so for three centuries up to 1900 B.C. Courty, a specialist in the field of soil micromorphology, noticed few earthworm holes in the soil-profile and windblown dust. She also encountered a layer of volcanic ash at some sites before the aridity set in and therefore argues that the climate change was triggered by a volcanic eruption around 2200 B.C. This view, however, has not yet been met with general approval, but there is absolutely no doubt about the climate change in the entire Mediterranean basin and the surrounding regions.

> The data was obtained by soil stratigraphy investigations through the entire region... The climate is characterised by the fall of volcanic ash, synchronous with repeated wild fires and a considerable increase of dust accumulation, together with evidence of cooling. Although the causative linkages between these various phenomena remains to be better understood interpretation of soil/climate data demonstrates a rapid intensification of the wind circulation regime, a deterioration of the rainfall, seasonal pattern and a related degradation of the vegetation cover. The contemporaneity of this event with a sudden occupation hiatus suggests that the farming soil potential remained severely reduced for nearly three hundred years before environmental conditions suitable for agricultural exploitation were re-established (Courty 1994).

Courty (1994) has re-examined the palaeoenvironmental data collected in the Indo-Gangetic flood plain and concludes that a similar sequence of events occurred at the end of the third millennium which marks the decline of the Harappan civilization. It may be noted that the evidence of earthquake has been recorded at Kalibangan, Banawali and Dholavira as well at the end of the Mature Harappan.

The evidence for climate change is no doubt convincing, but has been questioned by some who argue that there has been no climate change in India during the Holocene-last ten thousand years (Raikes 1967; Misra 1984). Gregory L. Possehl concludes that:

> There was no significant difference in the rainfall regime in the period from 7000 B.C. to 1000 B.C. as compared to today's long term pattern. Rainfall is dynamic, like other features of the environment and this position admits differences in yearly patterns, as well as longer term "cycles" of drought and rainfall abundance in the range of scores or even a hundred years also. The conclusion reached from the data which are presently available, is that changes in

> rainfall, or climate, should not be seen as an explanation for major historical events, such as the eclipse of the ancient cities of the Indus. (Possehl 1997: 212-13)

IV

After the decline of the Harappan civilization, lmost the entire country was dotted by early farming communities whose mixed economy was based on subsistence agriculture, stock-raising and hunting-fishing. They never attained prosperity and died as village cultures. Their village settlements were self sufficient, with little craft specialization. The people lived in mud huts, either rectangular or round, with wattle and daub walls and thatched roofs, made painted pottery and used tools of stone as also of copper which, however, being scarce was used on a restrictive scale. They cultivated barley, wheat, rice, peas, lentil etc and kept cattle, sheep/goat and pigs. They occasionally hunted wild animals, mostly deer, and caught fish and birds. They worshipped mother goddesses and some Chalcolithic communities buried the dead. They were organized into chiefdoms. Almost all these rural communities vanished from the scene towards the end of the second millennium B.C.

It is enigmatic that most of these cultures died out in the latter half of the second millennium B.C.; the settlements were abruptly deserted and were occupied again after a hiatus of about several centuries in the 6th, 5th cent B.C. A clue was provided by the Late Jorwe phase in the excavation at Inamgaon (Maharashtra) which was characterised by degeneration; large rectangular houses were replaced by small round huts, painted ornament on pottery is reduced to the minimum, agriculture dwindled and people had begun to subsist more on hunting. It appears that the most important factor in the decline was increasing aridity of the second millennium which was not confined to India only but was almost a global phenomenon. According to Khazanov:

> Almost all the palaeo-climatist accept that the second millennium B.C. was charactersed by a dry climate which, it would appear, was at its driest at the turn of the second and the first millennium B.C. Archaeological data would confirm this suggestion. (Khazanov 1986: 85).

He further adds:

> The fact that these dates coincide with the period of emergence of pastoral nomadism, as it has been established by archaeological data and written sources, is scarcely due to change. It would appear that the dry climate was the final stimulus for pastoralists to abandon agriculture once and for all and become fully nomadic (Khazanov 1986: 95).

The climate which began to deteriorate from c. 1800 B.C. worsens much more from c.. 1200 B.C. onwards. This also was a worldwide phenomenon and has been termed as the 'Dark Age' in ancient history which witnessed the fall of early powerful states in Greece, Anatolia, Egypt and Mesopotamia where droughts became frequent after c. 1200 B.C. (Bryson *et al.* 1974: 46-50; Burgess 1989: 325-26) The Nile records indicate that there was dramatic fall in the lake levels in East Africa around 1260+50 B.C. and agriculture almost entirely ceased in Nubia after the end of the reign of Ramses II. Dunes spread out the flood plain of the Nile and this situation continued till about 300 B.C. as thick salt incrustations suggest. Nile levels went down deeper after 1200 B.C. and hence grain prices increased 24 times because of failure of agriculture, even temple granaries became empty and there were food riots which are all well documented (Butzer 1983: 286). In this period Europe was facing severe winter which has been compared with 'nuclear winter' that the scientists believe will follow a nuclear war. Many habitations in England and Ireland were abandoned around 1200 B.C. and in many areas there were no settlements till about 900 B.C.

In India too, there were recurring droughts. In Central India, Western India and the Deccan the early farming communities seem to have resorted too a semi-nomadic existence from c. 1000 B.C. onwards till the beginning of the historical period in the 5th- 4th Century B.C. Recent scientific investigations in the west coast region provide corroborative evidence (Carratini 1993). The aridity appears to be far more severe in Central India, Western India and the Deccan where there is a hiatus from 1000 B.C. to 500 B.C. as no settlement belonging to this period has so far come to light. The Late Jorwe people deserted their settlements, from 900 B.C. In south too the Neolithic habitations were abandoned by 1200 B.C. The megalithic people appear on the scene but they do not seem to have enjoyed a fully settled life. This is evident from the fact that for over thousands of megalithic burial sites, the alleged habitation sites can be counted on finger tips. This happened in spite of the introduction of the technology of iron. In the north too the situation was not much different. Iron, which has been supposed to be the prime mover of urbanization, begins to occur from 1200 B.C. or even earlier. It does not seem to have improved the economy. The PGW people remained poor village folk for centuries (1200-600 B.C.) and could not attain an urban status in spite of their knowledge of iron technology. The great epic, the *Mahabharata* with which PGW culture is associated, also refers to extreme aridity during this period (MB 12. 139. 13-21). Incidentally it may be stated that the very first issue of *Cambridge Archaeological Journal* was devoted to the symposium on this problem. (James *et al.* 1991b).

It is interesting that the Nile flood data (Table 1; Fig. 2) is not much different from the climatic sequence that has been reconstructed by scientists (Krishnamurthy *et al.* 1981):

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Role of Surface Sites in Indian Palaeolithic Research: a Case Study from the Hunsgi and Baichbal Valleys, Karnataka

K. Paddayya and Richa Jhaldiyal

Department of Archaeology
Deccan College
Pune 411 006

Abstract

In India a large number of Stone Age sites have been reported from either surface or near surface contexts. However these sites have always played a peripheral role in Indian prehistoric research since they are thought to contain unreliable chronological, palaeoenvironmental and behavioural information. This paper tries to dispel these misconceptions about surface sites by presenting the results of surface studies in the Hunsgi and Baichbal valleys, Gulbarga District, Karnataka.

Introduction

During the last quarter-century Palaeolithic research in India has witnessed a significant reorientation both in its overall aims and in field and laboratory methods (Paddayya 1978). In lieu of customary culture-historical reconstructions Palaeolithic studies are now aimed at reconstructing human adaptations at the level of regional environmental settings. For this purpose it has been found necessary to shift the focus of field research from alluvial contexts and secondary sites associated with them to interior regions and identification of sites preserved in primary contexts. It has also been found necessary to redefine the concept of region in terms of natural features rather than administrative units and to replace hit-and-run type of field research with intensive foot surveys. Several excellent studies employing these reoriented goals and methodology have been done on the Palaeolithic and Mesolithic sites in different parts of the country (e.g. Murty 1968,1970,1981; Kenoyer *et al.* 1983; Jacobson 1985; Raju 1988; Pappu and Deo 1994; Selvakumar 1996; Basak 1997; Cooper 1997). These studies have contributed enormously towards the reconstruction of Stone Age behavioural patterns from the point of view of settlement system models.

A major aspect of this change in Indian Palaeolithic studies concerns the usefulness of surface sites. Many of the intensive regional surveys have brought to light in large numbers occurrences/localities preserving cultural material on or very close to surface, with little or no sedimentary cover. In fact, such sites constitute the major category of Stone Age localities. Surface sites have been found in a variety of geomorphic/sedimentary contexts (e.g. on dune surfaces, on rock exposures, on the surface of Neogene/Quaternary deposits, on hill slopes, on pediment surface (foothill regions), and in agricultural fields. From their contexts it can be inferred that either these surface sites were never covered by sediments or else have been exposed to surface in subsequent times by natural processes like deflation and erosion of sediments and anthropogenic agencies like tillage.

Despite the fact that surface sites have proved to be a very vital source of information for attempting settlement system reconstructions, the usefulness of these sites has not been accepted in Indian Palaeolithic studies to the extent they really deserve. In Indian prehistoric research biases against surface sites have crept in largely because of its preoccupation with building up of stratigraphical-cultural sequences and reconstruction of palaeoenvironments. Since surface sites can provide neither the much-desired chronostratigraphic control nor any palaeoenvironmental data, they continue to be ignored; Stone Age sites associated with thick sedimentary deposits remain the main focus of research. Secondly, an implicit assumption still widely persists that Stone Age sites capable of yielding reliable information about ancient human behaviour are necessarily those that occur underneath thick sedimentary cover (similar to the Olduvai Gorge localities). This notion, or what may be called the Olduvai Gorge complex, has exercised enormous influence on the minds of the Indian prehistorians.

This paper seeks to remove these misconceptions about surface sites and demonstrate that by following a regional approach and a formation processes perspective, the role of such sites can be expanded to yield critical information for the reconstruction of past lifeways. For this purpose the field studies carried out over the last quarter-century on the Acheulian sites of the Hunsgi and Baichbal valleys, particularly the recent work at the site of Isampur, will be used as an illustration.

Surface Studies in the Hunsgi and Baichbal Valleys

The Hunsgi and Baichbal valleys, located in the Gulbarga District of Karnataka, constitute an erosional basin of Tertiary age. They cover an area of 500 km^2 and are surrounded by low tablelands of shale and limestone which are spread over an additional area of 500 km^2. Prolonged studies in this area since the 1970s have revealed a rich Stone Age record ranging from the Lower Palaeolithic to the Mesolithic. The Hunsgi and Baichbal valley project was especially aimed to investigate the Acheulian sites occurring in the area. In age these range from 200 kyr .to beyond 350 kyr (Szabo *et al.* 1990). One of the unique features of the Acheulian culture of these valleys is the use of limestone as the principal raw material. Nearly 200 small and large sites in a variety of depositional contexts on the valley floor have been located during field studies. At most of the sites the cultural material occurs on or very close to surface. Notwithstanding their open-to-sky condition, the cultural material (in some cases even animal fossils) is preserved at a majority of the sites in the form of discrete clusters of artefacts. Hence these sites have been treated as primary occurrences, well suited for reconstructing Acheulian behavioural patterns. The excavations conducted at two localities near Hunsgi and at one locality near Yediyapur strengthened this observation by way of exposing *in situ* Acheulian levels beneath 15 to 30/40 cm thick silt deposit (Paddayya 1977,1982, 1987a).

An attempt was made to reconstruct the Acheulian lifeways of the region from a settlement system perspective (Paddayya 1982, 1987b). This was done by combining the data, such as the nature and size range of sites and their distribution on the valley floor with reference to various topographic features obtained from intensive foot surveys and excavations with observations about palaeoenvironmental setting of the region, inferred from ethnographic data bearing upon plant/animal foods and water sources. The Acheulian settlement system of this region hinged on two principal seasonal resource management strategies — a) dry-season aggregation of the groups near perennial water pools (as provided by seep-spring flows) in the central part of the valley floor and reliance on large game hunting; and b) wet-season dispersal all over the valley and emphasis on the role of small fauna and plant foods.

While the above-mentioned settlement system approach adopted in the Hunsgi and Baichbal valleys project was favourably received by workers, particularly in Europe and North America, simultaneously some queries were also raised regarding the sedimentary context of the sites. In particular, doubts were expressed about the level of integrity of the cultural record found at the surface sites which account for the vast majority of recorded sites in the area (e.g. Straus 1983).

These queries and doubts led to a more detailed examination of the sedimentary and topographic contexts of the sites. For carrying out this work the newly emerging perspective of site formation processes proved to be tremendously useful. The site contexts were studied in relation to topographic settings, sedimentary matrix, local lithology, drainage features, and contemporary land-use conditions. The topographic settings of the Acheulian sites include the foothill/pediment zone of limestone uplands and channel banks and slopes of the interfluves of the valley floor. Here the cultural record occurs on hard substrata (weathered and unweathered bedrock and calcretes), on soft sediments (travertine and clayey silt deposits), on the surface of colluvial and fluvial gravels, and, in some cases, within these deposits. These studies also clearly showed that there exists a large variability in the preservational contexts of the sites. These were classified under four categories: a) secondary fluvial sites; b) colluvial sites; c) sites modified by surface runoff; and d) *in situ* or primary sites (Paddayya 1987c; Paddayya and Petraglia 1993, 1995; Jhaldiyal 1997a). A somewhat unexpected but useful outcome of these detailed investigations of the topographic and sedimentary contexts of the Acheulian sites concerned the identification of two chronological stages within the Acheulian culture — a) Early Acheulian assemblages found on hard surfaces like weathered/unweathered bedrock (as at Hunsgi V, Yediapur IV) and b) Evolved Acheulian assemblages found within soft sediments comprising brown clayey silts (as at Mudnur and Teggihalli localities).

The sites occurring in fluvial and colluvial deposits were in a derived context. These suffered loss of spot provenance, i.e. the cultural material was displaced from the original spots of occupation or use and discard. However, it should be pointed out that, unlike the alluvial sites found on major rivers which experience erosional/depositional processes covering long distances, the distances involved in the relocation of the cultural material of the Acheulian sites in the Hunsgi and Baichbal valleys would have been short (a few meters to a few hundred meters) on account of the enclosed nature of the basins.

At the sites modified by surface runoff the cultural material was still found within the confines of their original places of discard. Subsequent to the exposure of stone artefacts at the surface due to erosion of soil cover, surface runoff introduced intrasite modifications in their spatial positions. The lithic clusters were subjected to some degree of horizontal spreading and some of the small-size artefacts of the assemblage were eroded away under the impact of surface wash processes.

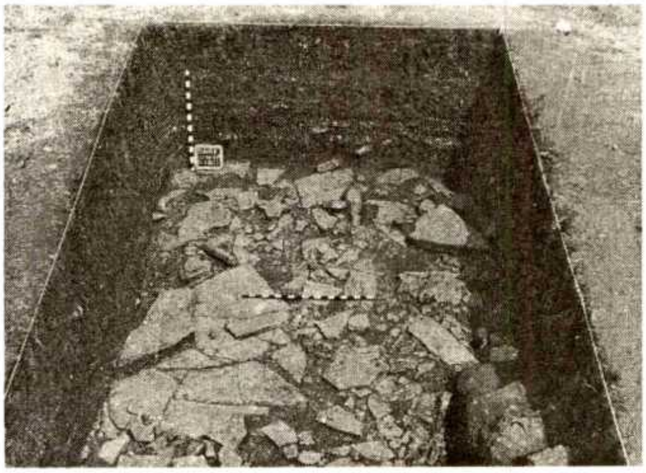

Fig. 1: Acheulian horizon exposed in cutting 6, close to Isampur-II site, underneath 1.4 m thick sediment consisting of various levels of black silt interstratified with gravel lenses

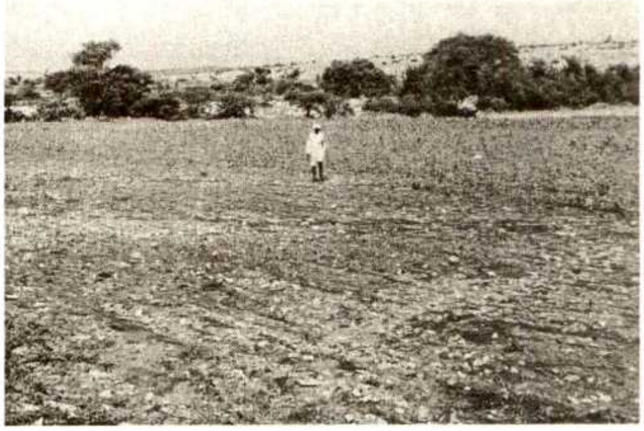

Fig. 2: Acheulian site at Kolihal (2 km northwest Isampur-II) in Hunsgi valley, showing cultural material exposed due to removal of overlying black silt by rill erosion

The *in situ* sites in contrast were least disturbed as they were still under varying amounts of sediment cover ranging from 10 cm to 2 m (Fig. 1). The majority of sites found in the two valleys belong to this category. The artefacts were occasionally brought to the surface by ploughing but otherwise these were not affected by contemporary processes of disturbance like gravity induced displacement and surface runoff. In many of these sites the underlying artefact assemblages were partially exposed to surface due to rill erosion (Fig. 2). In fact during explorations it was always these visibly distinct, eroded patches in agricultural lands that gave evidence (by exposing part of the buried artefact assemblage) for the presence of an Acheulian site.

The reinvestigation of sites and their classification based on the contexts of preservation, thus made it apparent that the surface condition of the sites is a recent phenomenon. Continuous ploughing for many hundred years, accompanied by soil erosion as induced by surface runoff, was found to be the main agents responsible for the slow depletion of the soil cover and consequent exhumation of the ancient cultural record to the surface. Our repeated observations of artefact behaviour in the ploughzone, investigation of traditional tillage methods and experimental studies showed that the cultural material at all these sites, although found on the surface are still well preserved and satisfy the criterion of spot provenance and even that of point provenance in many cases[1]. Two major factors contributed to the preservation of the Acheulian cultural material. First, the traditional agricultural implements used in the area are very simple and penetrate the soil up to a depth of 12 to 15 cm. Further, as pointed out by Wallace long ago (1888: 174), the traditional Indian plough merely stirs up the soil without turning it over; so the scope for displacement (vertical or horizontal) of its contents is limited. This is particularly true of lithic materials found on Acheulian sites that contain a high proportion of heavy or large artefacts. Field studies involving experimental ploughing and stone artefacts confirmed the non-drastic nature of the effects of traditional tillage (Jhaldiyal 1997b). Secondly, the traditional agricultural practices in the study area which have essentially remained unchanged since ancient times, have supported soil conservation by following crop rotation, single cropping,land fallowing and shallow tillage of soils by animal drawn implements. It is only since the introduction of irrigation (which has led to intensification of agriculture) that the valleys have witnessed accelerated soil erosion.

As concerns the effects of surface runoff, our field observations show that even this process affects the integrity of the exposed Stone Age material only marginally. The enclosed nature of the two valleys, gentle gradient of the valley floor and the shallow depth of waterflow contributed to the non-drastic nature of the effects of surface runoff. The ill effects of runoff were to an extent offset by ground vegetation, particularly grass cover which shoots up immediately after the addition of moisture to soil from precipitation. The experimental plots set up in the area did not show any significant displacement of the stone

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[1] The phrases spot provenance and point provenance were first used by the senior author (see Paddayya and Petraglia 1995:346-7) in order to arrive at a primary level categorization of preservational contexts of Stone Age sites. Spot provenance refers to cultural material which, while it may have undergone some amount of horizontal or vertical displacement, is still preserved within the spatial limits of original spots or localities. Point provenance refers to the preservation of individual items in the positions in which they were left behind by the site occupants.

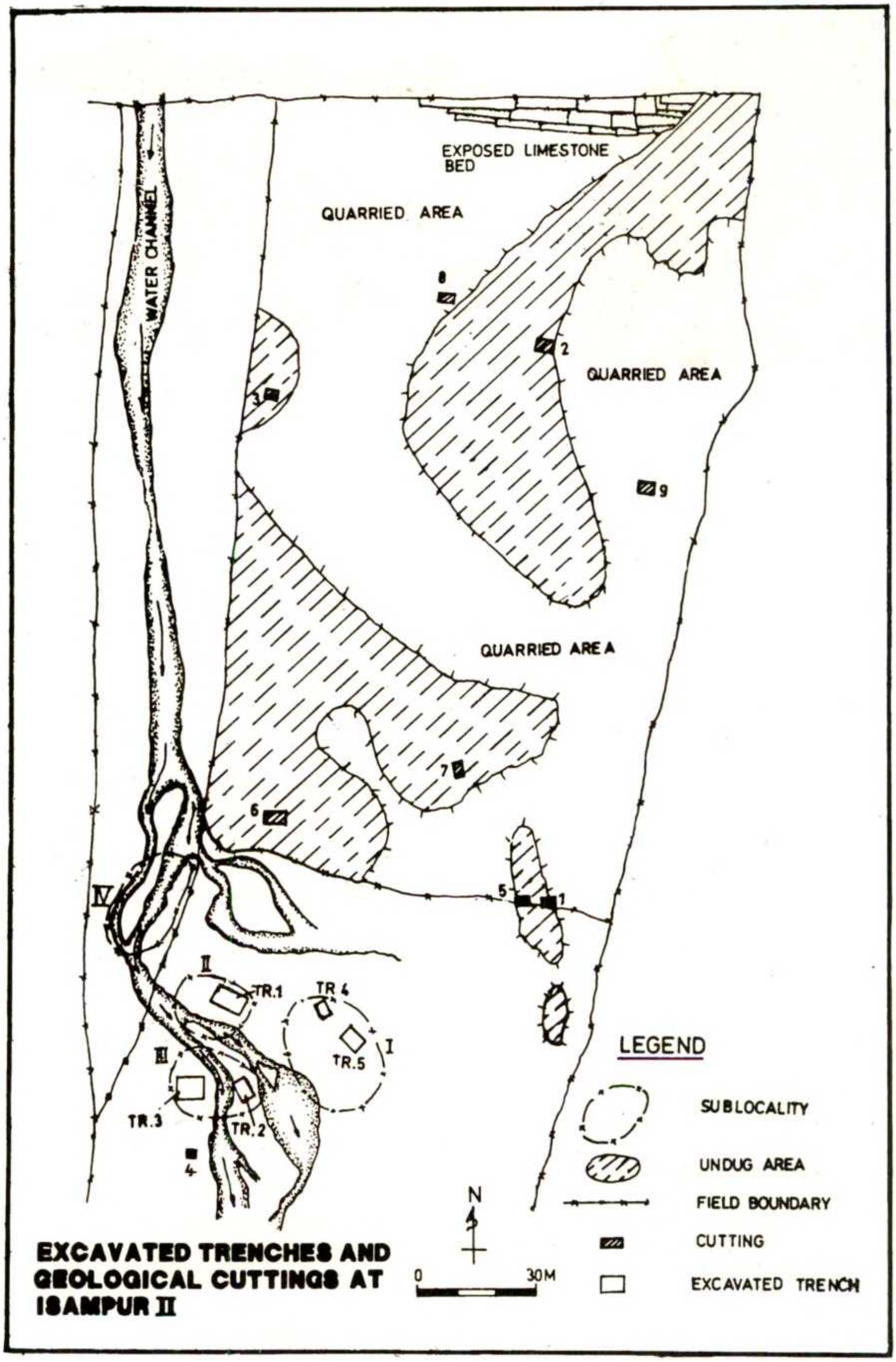

Fig. 3: Map of the Acheulian site of Isampur-II, showing sublocalities(I-IV), excavated trenches (1-5) and geological cuttings (1-9)

pieces planted on surface. Some of the smaller pieces even showed a tendency to get embedded under soil cover that either stopped or retarded their downslope movement (Jhaldiyal 1998).

Our observations are supported by the experimental work of soil scientists in the neighbouring Sholapur District of Maharashtra. They showed that lands under vegetation cover of weeds recorded a minimum soil loss in comparison to cultivated or fallow lands (Table 1). These studies also highlighted the differences in soil erosion rates between fallow lands (ploughed and unstirred) and those which were ploughed up to different depths.

Table 1: Soil erosion rates under various landuse conditions (After Kanitkar *et al.* 1960)

Land Use	Soil Loss(tons/acre/annum)
Bare fallow (ploughed)	40.50
Bare fallow (unstirred)	18.04
Vegetation cover of weeds	00.60
Shallow cultivation (10 cm depth)	30.19
Deep cultivation (18 cm depth)	40.52

The belief that many of these sites were disturbed but only in a limited way was reinforced while mapping surface assemblages at many sites. This work proved to be extremely helpful in understanding various cultural aspects of the Acheulian record. For example, the mapping of artefact clusters at Fatehpur V showed that it was a multipurpose site where tool manufacture, food processing and occupation related activities took place. Similar studies were done at Mudnur VIII, Kudalgi II, Isampur II, Yediyapur II, and other localities. These surface studies helped in identifying multipurpose sites as well as sites where specific activities like tool caching, food-processing and tool manufacture had taken place. The fresh condition of artefacts and presence of small-size debitage also showed that the assemblages at these sites lay until recently under a sedimentary cover. This observation gained further strength when excavations at localities of Hunsgi V, and VI, and Yediapur VI exposed the cultural horizon underneath 30 to 40 cm sedimentary cover, which left no scope for disturbance by contemporary land modification processes.

Surface Studies at the Acheulian Site of Isampur II

As part of the above-mentioned work dealing with formation processes of the Acheulian sites of the region, one of the localities at Isampur (Locality II) was taken up for detailed studies including excavation. This site is located in the northwestern corner of the Hunsgi valley and was discovered in 1983 when the Acheulian cultural material was exposed to surface due to quarrying away of the silt deposit (2 to 2.5 m thick) overlying the bedrock by the Irrigation Department. Subsequently land modification activities involving field bunding, land levelling, ploughing, and soil erosion by a water channel carrying waste waters from irrigated lands, led to a more prominent exposure of cultural material comprising both finished artefacts, hammerstones and by-products of tool manufacture including cores. It was therefore decided to take up the site for detailed investigations (Fig. 3). Five seasons (1997-2001) of systematic surface studies and excavation, and a detailed examination of geoarchaeological features of the surrounding area, revealed that this site is one of the richest and best preserved Lower Palaeolithic sites in the World (Paddayya and Petraglia 1998; Paddayya *et al* 1999, 1999-2000, 2000; Petraglia *et al.* 1999; Petraglia and Paddayya 2001).

Nine geological cuttings and 30 trial pits (1x1 m) revealed that the site lay on a weathered limestone outcrop close to the edge of a palaeochannel having perennial waterpools. The cultural horizon was subsequently covered by 2 to 2.5 m thick brown and black silts that were quarried away by the Irrigation Department. Careful examination and plotting of the cultural material exposed to the surface, coupled with regular excavation of 5 trenches (159 m^2) in areas still covered with silt deposit varying in thickness from 10 to 50 cm, revealed the following major features of the site:

a) The site covers a total area of about 7200 m^2.

b) Despite soil quarrying and farming activities a remnant sedimentary cover ranging in thickness from 10 to 50 cm is still left on the site.

c) It was a major workshop-cum-occupation site geared to the exploitation of a weathered limestone bed of siliceous character and containing blocks of suitable shapes and sizes.

d) There existed a variability in the preservation of the Acheulian level, ranging from fluvially transformed situations (Trench 2) to partially modified situations of more recent times due to field channel digging and soil quarrying (Trench 3) to well preserved *in situ* contexts (Trenches 1, 4 and 5).

e) The site yielded over 15,000 artefacts from the excavated trenches in addition to several thousand artefacts exposed on the surface. The study of this material led to a fresh understanding of the various aspects of Acheulian lithic technology including raw material selection, various reduction strategies and recognition of artefact types other than the commonly occurring bifacial tools.

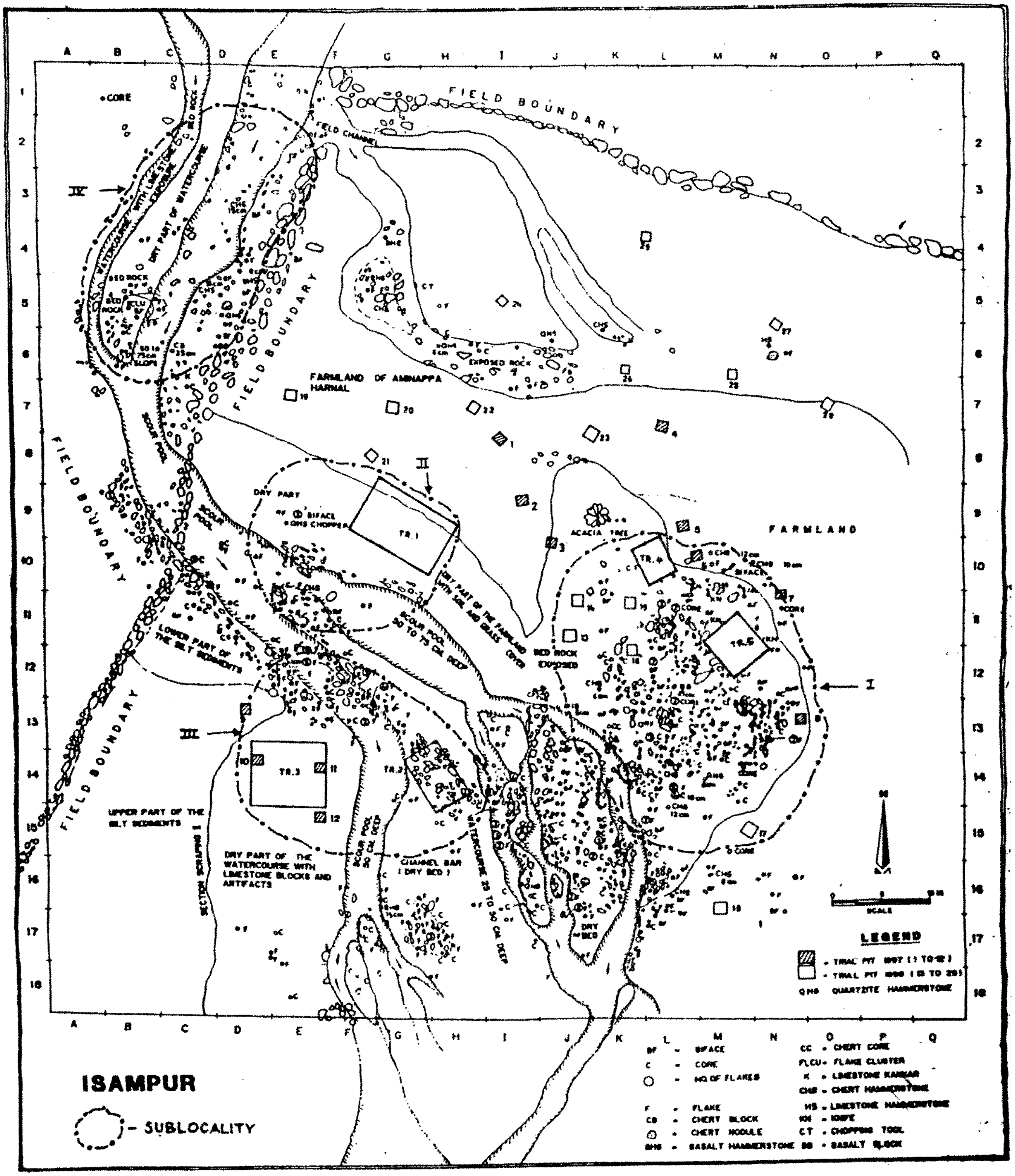

Fig. 4: Map of Isampur-II Acheulian site, showing surface distribution of cultural material and limestone blocks, spatial positions of sublocalities (I-IV) and excavated trial pits and trenches

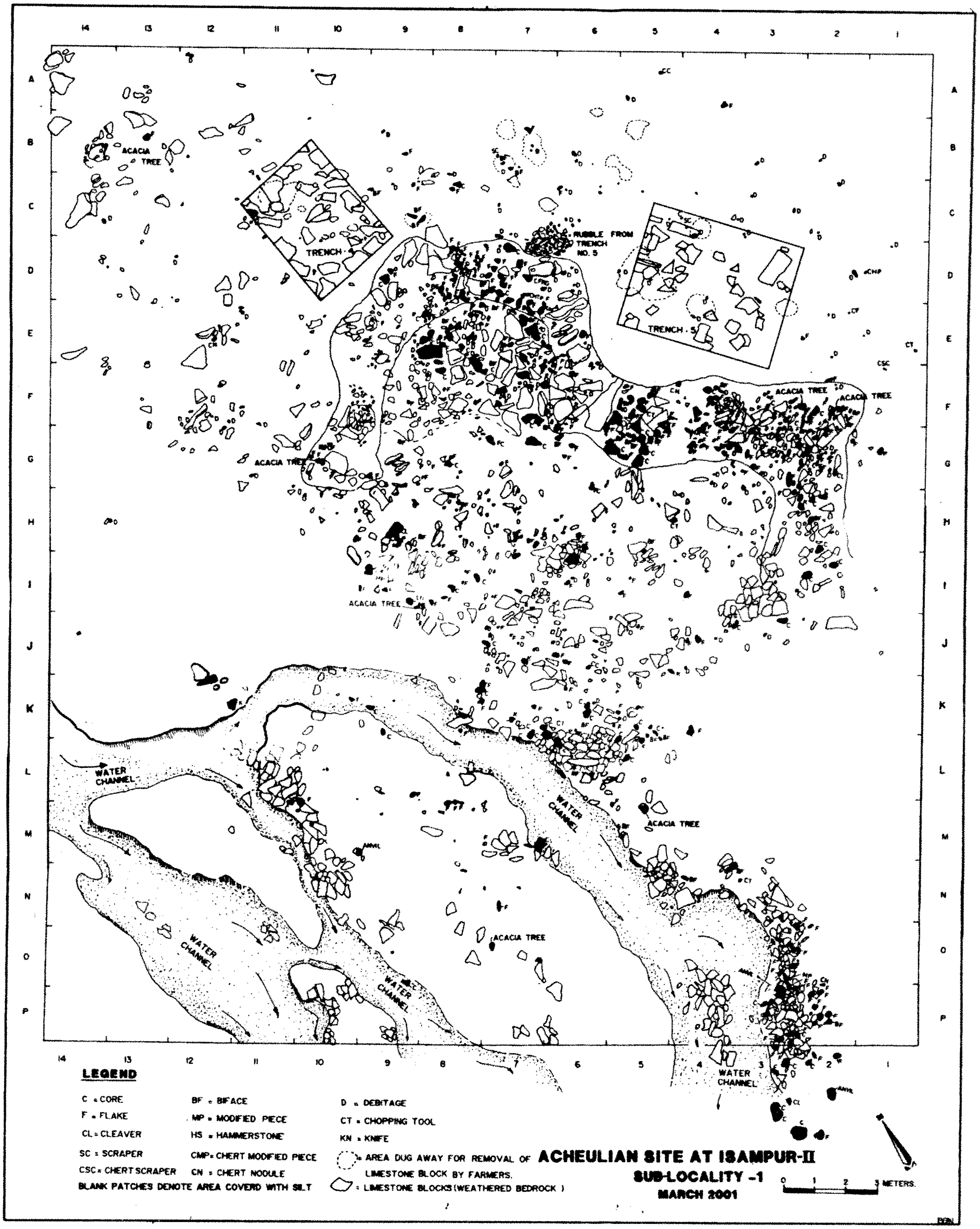

Fig. 5: Map of sublocality-I at the Acheulian site of Isampur-II, showing the distribution of cultural material, limestone blocks and excavated trenches (4 and 5)

f) The site was a localized hub of manufacturing and occupation activities. It was occupied by a band of hominids comprising several family units. From this centralized location the hominids radiated to the surrounding uplands and the valley floor for their daily foraging activities.

In addition to the above aspects, this detailed work led to the identification of four sub-localities on the site, each covering an area of 500-700 m^2 and separated from each other by diffuse scatters of cultural material (Fig. 4). These sub-localities consist of dense patches of cultural material comprising debitage, cores, hammerstones and complete tools.

In sub-localities 2 and 3, Trenches 1 and 3 were excavated and yielded *in situ* cultural material under 25 to 50 cm thick sedimentary cover. Sub-locality 4 is located within the water channel and on account of the erosion of silt cover much of the cultural material has been exposed and displaced.

It is sub-locality 1 which has provided useful lessons about the present topic concerning the importance of studying surfaces sites. This sub-locality forms the southeastern part of the Isampur site and occupies an area of about 700 m^2 (Figs. 5-6). It forms part of farmland and a small portion on the western side is occupied by water channel. Like other parts of the Isampur site the overlying silt cover was quarried away leaving behind a thin soil cover (10-20 cm). Subsequently the owner took some steps to use this stretch for raising crops. This involved certain amount of modification of surface features such as levelling, bund-making, digging of field channels and dislodging of large limestone blocks. However, because of the uneven nature of the surface and the exposure to surface of limestone blocks, the patch could not be used for crop raising purposes in any regular way. As a result, much of the area was transformed into a barren patch covered with grasses, shrubs and *Acacia* trees.

Quarrying of the silt cover by the Irrigation Department exposed a tremendous amount of cultural material ranging from large cores to hammerstones to finished tools and debitage including chips and flakelets. The trial pits and two small trenches (Trenches 4 and 5) excavated in this sub-locality revealed rich and intact Acheulian cultural material similar to that encountered in Trenches 1 and 3 (Figs. 7-8). An entire field season spanning three weeks in March 2001 was devoted to a systematic documentation of the various features of the sub-locality. This work included:

1) Gridding of the entire area into 5x5 m units to facilitate detailed recording of the natural and cultural features;
2) Careful scrutiny of surface features such as patches covered by stone blocks, vegetation and soil cover;
3) Exposing of artefacts and stone blocks which were already partially brought to the surface due to various land modification activities by using knife and brush;
4) A general study of the nature and distribution pattern of cultural material (Figs. 9-10) ranging from large cores to small chips and its preservational context including spatial displacement; examination of the physical attributes of artefacts such as breakage and surface smoothening; and
5) Plotting of all artefacts and stone blocks exposed to surface in various portions of the locality due to digging of field channels, preparation of field bunds, displacement/quarrying of large stone blocks, erosion by water channel and other land modification activities of recent times.

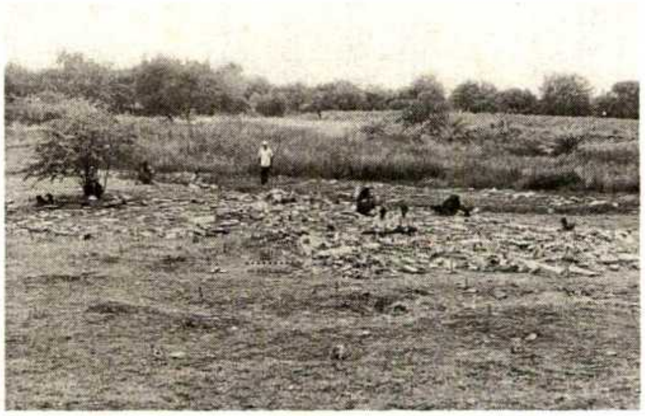

Fig. 6: Northeast-facing view of sublocality-I (divided into 5x5 m grids) at Isampur-II showing Acheulian cultural material and limestone exposed on surface

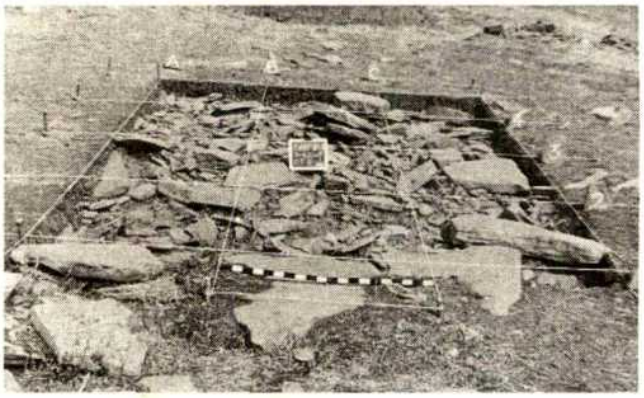

Fig. 7: View of Trench 4 (4x3 m) excavated at sublocality-I of Isampur-II, showing limestone slabs and cultural material beneath 20 cm of black/brown silt

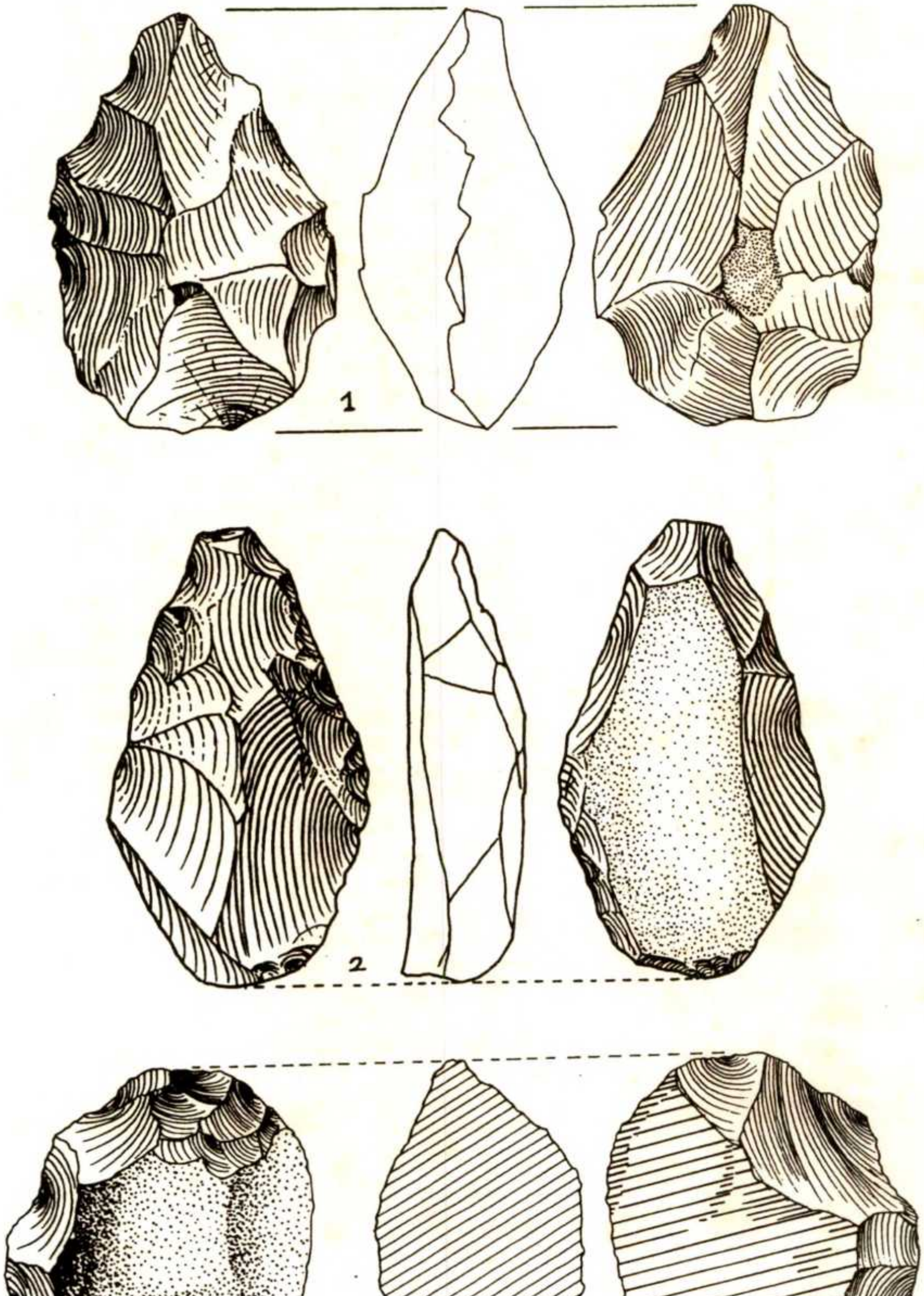

Fig. 8: Handaxes on limestone slabs (Nos. 1-2) and chopping tool (No. 3 of pegmatite), from Trench 5, excavated at sublocality-I of Isampur-II

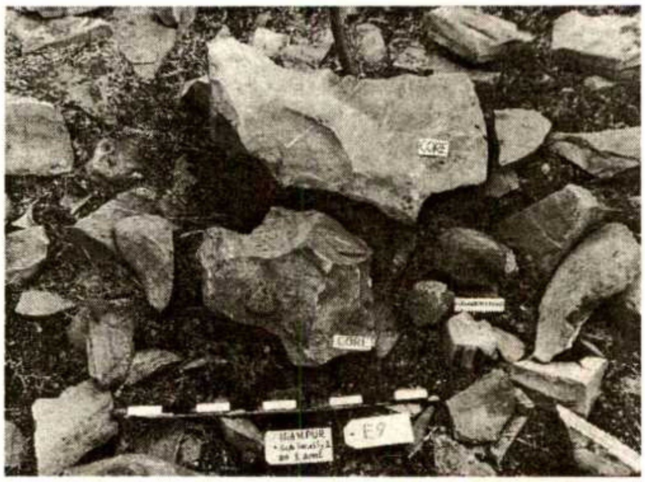

Fig. 9: Limestone cores and flakes exposed on surface in Grid E9 at sublocality-I of Isampur-II

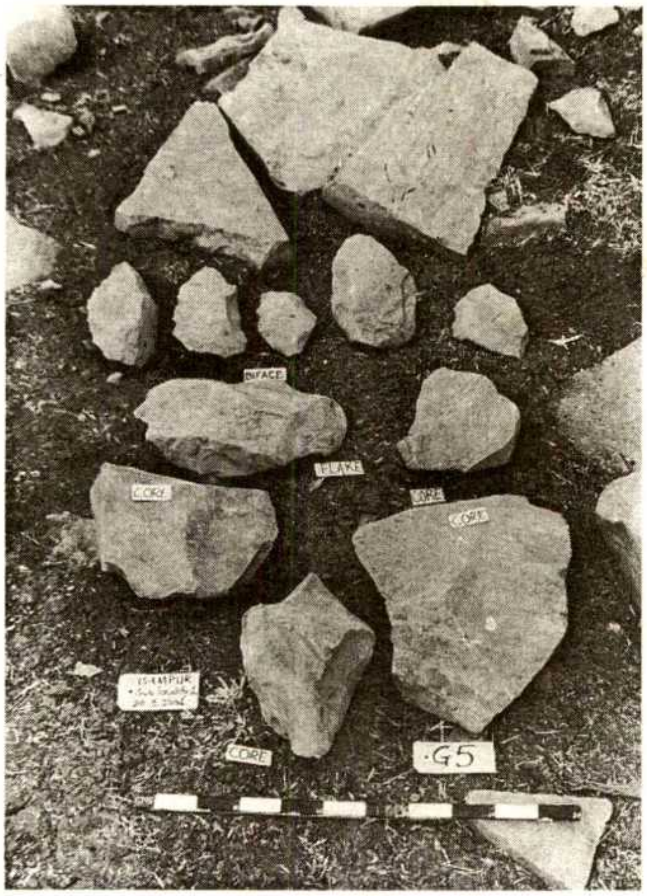

Fig. 10: Bifaces and other artefacts of limestone exposed on surface in Grid G5 at sublocality-I of Isampur-II

The main conclusion is that the cultural record at this sub-locality is extremely well preserved and is very suitable for behavioural interpretations. While it must be conceded that its level of integrity is not as high as that of the material found in sealed contexts identified in trenches 1,4,5 and that the individual objects have lost the attribute of point provenance in many cases, still it was very clear that both cultural material and stone blocks did not suffer largescale disturbance due to recent land modification activities. Horizontal displacement ranging from a few centimetres to a couple of metres, smoothening of artefact surfaces, breakage due to trampling, fire and ploughing, and use of stone blocks for bunding were noticed Though the attribute of point provenance may have been lost in many of the pieces and it may not be possible to identify activity areas like chipping clusters as revealed in Trench 1, still the cultural record found at this sub-locality is extremely well preserved in terms of spot provenance. It proved to be very useful for understanding several aspects of the Acheulian culture including tool typology and reconstruction of tool reduction sequences.

A detailed attribute analysis of over 262 artefacts forming the plotted surface assemblage of this sub-locality was undertaken. The artefacts were classified on the basis of morphological features and metrical attributes such as length, breadth, thickness and weight. Other features like raw material, flaking angle, planform, cross-section, number of flake scars, platform characteristics and cortex percentage were also recorded. The study brought to light a large variety of shaped tools, cores and flakes. A total of 64 shaped tools were recorded of which 21 were made on flakes, 3 on cobbles and the remaining ones on slabs of limestone. The shaped tools included handaxes (45), chopping tools (9), cleavers (7), scrapers (2) and knife (1). Hammerstones (12) of chert, limestone, basalt and quartzite were also documented. The surface documentation also brought to light three large discoidal limestone blocks showing steep flaking around the circumference and were thus classified as anvils. Cores were also found in a large number, a majority of which were on limestones blocks (52), while two were on limestone flakes and another two on chert cobbles.

Most of the limestone blocks used as cores ranged in thickness from 8 to 17.5 cm. Besides shaped tools, cores, hammerstones and anvils, 127 flakes were also studied. While many of the flakes were clearly blanks detached for manufacture of artefacts, there were several flakes which appear to have been used directly for cutting/chopping purposes. Secondly, the large number of flakes exposed to surface facilitated the identification of variability in the forms and types of flakes. This variability clearly indicated that most of the flakes were removed with systematic prior planning, which helped the hominids to replicate flake types.

Discussion

The foregoing observations about the sedimentary and cultural contexts of the Acheulian sites of the Hunsgi and Baichbal valleys in general and the more recently excavated site of Isampur in particular serve to highlight the role that surface sites can play in Indian Palaeolithic research.

First, it is very clear that the skepticism with which the surface sites were treated in traditional Palaeolithic research is no longer justified. As mentioned at the outset, prehistorians in India have been under the spell of 'Olduvai Gorge' complex, i.e. a belief that good and well-preserved Stone Age sites can be visualized only when they are found under thick sedimentary cover. It is this kind of mental attitude which has made prehistorians, barring a few exceptions (e.g. Jacobson 1985; Pappu and Deo 1994; Allchin and Allchin 1997: 50-52), ignore the significance of surface sites.

Secondly, the surface character of these sites has been wrongly treated as an inherent attribute. Implicit in this notion is the belief that no sedimentary cover developed over them at any stage. Studies like the ones in the Hunsgi and Baichbal valleys show very clearly that in many cases these sites were subsequently covered by silts and clays. Furthermore, geological cuttings around the site of Isampur revealed that many short and minor depositional phases were involved in the deposition of 2 to 2.5 m thick silt. The occurrence of this sediment cover over the Palaeolithic cultural material and the short and minor character of the episodes in its formation should serve to reassure that the integrity of Stone Age levels has not been affected in any significant way.

Thirdly, these detailed studies also go to disprove the belief that surface sites do not provide chronological control. As mentioned earlier, a closer examination of the topographical and sedimentary context of the sites enabled us to recognize two chronological stages in the development of the Acheulian culture. What is even more significant is that some of these sites have yielded fossil fauna and sediments like travertine which have been used for absolute dating by U/Th series technique. Coming to the Isampur site itself, an herbivore tooth found in Trench 1 has recently been dated by electron spin resonance (ESR) method. Preliminary ages for the tooth averaged more than one million years (Blackwell *et al.* 2001).

Fourthly, these studies clearly prove that the surface context of many of these sites is a post-depositional phenomenon of more recent times. The principal agent responsible for the re-exposure of sites is the land modification activity connected with farming. In the Hunsgi and Baichbal valleys farming commenced during the Neolithic period which has an antiquity of 4000 years. It was intensified with the introduction of iron in the succeeding Iron Age. Inscriptions belonging to the later Chalukyan-Rashtrakuta times (9 to 10 centuries A.D.) record land grants for the maintenance of temples. The post-Independence period witnessed large-scale reclamation of virgin lands due to population increase. One must therefore readily concede that the sedimentary cover of the valley floor underwent a considerable degree of modification and displacement under the impact of these long-standing tillage activities. However that be, the various studies done in the area as part of the present research project illustrate in a clear way that, while tillage and tillage-induced erosion by forces like surface runoff have removed a substantial portion of the overlying sedimentary cover, still the cultural material is preserved in many cases in a more or less undisturbed condition[2].

These studies amply prove that surface sites, once these are approached with a repertoire of field documentation techniques (for mapping of cultural and other features, sampling and collection, and excavation) appropriate to the sedimentary/preservational contexts of particular sites and the nature of cultural material occurring on them, can yield a significant body of information about the country's distant Stone Age past. Here one must also remember that these surface sites, far from being a curse on the Indian Stone Age studies, are actually a blessing in disguise, because in comparison to buried sites their investigation involves far less effort in terms of time and money.

It is these advantages of surface sites which have already been fully recognized in archaeological studies in North America, Europe and Africa (e.g. Lewarch and O'Brien 1981; Garth Sampson 1985, 1998). The impetus to design research strategies to document and utilize the surface archaeological record was largely prompted by the exigencies of Cultural Resource Management projects which perforce covered large numbers of sites commonly found in unstratified surface contexts. It is also from these studies that plowzone archaeology emerged (O'Brien and Lewarch 1981). The surface context of the archaeological record also prompted archaeologists to adopt a non-site or off-site approach (Thomas 1975; Foley 1981; Dunnell and Dancey 1983). This approach lays emphasis on a) defining the regional archaeological structure where the artefact instead of the site forms the unit of observation; and b) adopting systematic survey and collection strategies where the cultural and natural processes that affect the surface archaeological record are investigated, so that the surface record can be used for understanding long-term land-use patterns (*e.g.* Foley 1981; Rossignol and Wandsnider 1992). It is worth remembering that the core ideas of these recent research strategies were already being advocated by L.R. Binford in his famous article on "A Consideration of Archaeological Research Design" published in 1964 (Binford 1972: 135-162).

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[2] Consequent upon the introduction of irrigation in the 1980s the archaeological sites in the Hunsgi and Baichbal valleys have been experiencing impacts of various kinds. Quarrying of soil sediments, land-levelling, deep ploughing by power-driven tractors, digging of irrigation canals and road-laying have either destroyed or caused large-scale modification of archaeological sites of various periods, ranging from simple lithic scatters to regular mounds (for details see, Paddayya 1996). The Stone Age sites, because of their minuscule character on the landscape, have undergone rapid transformation. The two major concentrations of Acheulian sites in the area (one each in the Hunsgi and Baichbal valleys) have been altered drastically and sometimes destroyed beyond recognition in the last one decade. The silt covered rocky patches which were earlier uncultivated have been converted into paddy fields.

Thus surface sites have been accepted as one of the most important components of the archaeological record in contemporary archaeology. Studies like the ones in Hunsgi and Baichbal valleys should allow workers in India too to discard the misgivings which are traditionally associated with surface sites and accord to them due place in the investigation of the Palaeolithic record of the country.

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Holocene Episodes of Colluvial Deposition at Kalapet near Pondicherry

Hema Achyuthan, Savita Ghate[1], Sushama G. Deo[2] and Sheila Mishra[2]

Centre for Geoscience and Engineering,
Anna University,
Chennai 600 025

1 Dr. Ambedkar College of Arts
and Commerce,
Jaijawan Nagar, Yerawada,
Pune 411 006

2 Department of Archaeology,
Deccan College,
Pune 411 006

Abstract

A spectacular feature seen near Pondicherry is a 40 m deep gorge cut into the Cuddalore sandstone of Miocene to Pliocene age. This gorge is around 1 km long and is graded to a lower sea level. Closer to the sea, a series of colluvial gravels are found filling the gorge. Microlithic artefacts were found close to the edge of the gorge and post date the gorge formation. Quartz microlithic industry is found in the lower colluvial gravel and Megalithic pottery in the upper colluvial gravel. This shows that there were two distinct phases of colluvial deposition, which may relate to minor changes in climate, vegetation, sea level or human activities near the site.

Introduction

The coastal rivers in the study area are confined in narrow valleys cut around 10-30 m below the interfluves. While the interfluvial areas have good record of Lower to Middle Pleistocene, the valley areas are filled with recent sediments. Achyuthan (1996) reported a date of 6,905 ± 120 B.P. obtained on alluvium at the Kosapur locality on the Koratallaiyar river. The near coastal and near channel areas of the landscape, therefore, are more dynamic and preserve younger deposits. The interfluves are less dynamic and preserve an older record. The site of Kalapet near Pondicherry is one of such sites (Fig. 1), which shows some of the minor landscape changes during the Late Pleistocene and Holocene. A 40 m deep cut gorge is seen near Pondicherry. It is cut into the Cuddalore sandstone of Miocene to Pliocene age. It is around 1 km long and is graded to a lower sea level (Fig. 2). It is formed on a small ephemeral stream with a basin area of only 0.6 km. Wohl and Achyuthan (2001 in press) have shown that the gorge form is related to the substrate resistance, with narrower and deeper walls in the indurated alluvium.

Field Observations

Kalapet is located about 150 km south of Chennai near old Pondicherry on the East Coast of India. It is situated on red Cuddalur sandstone of Miocene age. Archaeological material was found in two contexts in relation to the gorge. The first context was on the surface near the gorge edge. This assemblage consists of microliths. The raw material used to make the tools is quartz pebbles derived from the Cuddalore sandstone. Quartz flakes, microlith cores and a few microliths were collected from the surface (Fig. 3). The second context was about 6 m thick gravel deposit (Fig. 4 and 5). This deposit is 2 m above sea level, 500 m away from the present-day shoreline, and about 2 km south of the gorge. The appearance of this fill is like a channel bar (Fig. 4A) where the top 2 m is of thick black soil. In between 2 to 3 m below the surface, is a sand unit that contains mud balls, charcoal and burned mud pieces. A mud ball horizon at the base of the sand shows a break between the two colluvial gravel units. This sequence is repeated twice. Colluvial gravels are unsorted and have well-rounded pebbles and sand. The upper colluvial unit yielded pottery. The sandy unit between 3 to 5 m below the surface contained microliths similar to those found at the edge of the gorge in the upstream locality. The pottery is thick and coarse. The sherds do not have any slip or other decoration and have a sand temper. These most probably come from Megalithic urns, which are reported from the area (V. Selvakumar: personal communication). A few fine sherds also occur in the assemblage. Mono-directional flaking technique is applied in making microliths. This advanced tool technology and a fluted core in the assemblage indicates the artefacts collected on the surface of the gorge are of the Mesolithic period.

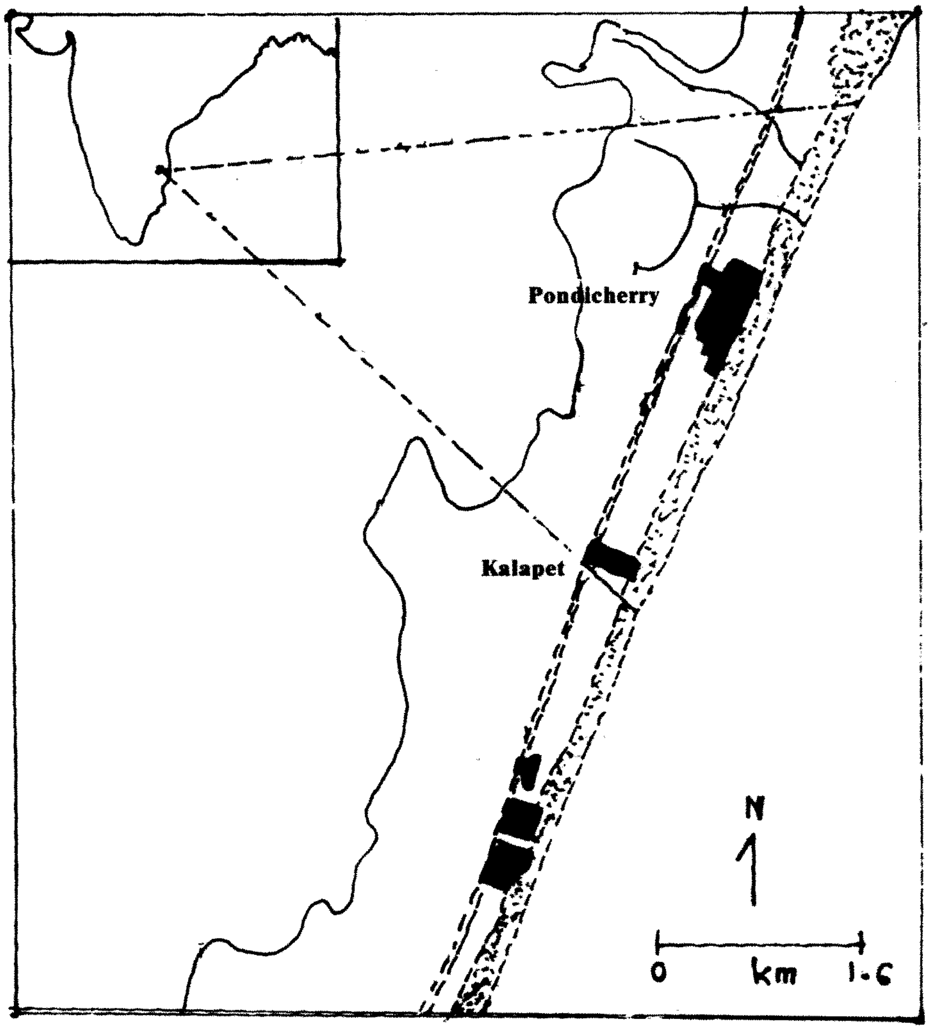

Fig. 1: Kalapet: Location map

Discussion

The formation of a gorge so close to the sea and deposition of 6 m thick colluvial gravel in absence of any significant slope or drainage catchment raises many questions. The gorge is an anomaly in its present setting. The absence of any significant slope or drainage catchment for the gorge is enigmatic. The formation of the gorge in the present-day setting is difficult to explain. There are two possible explanations for the formation of gorge. Firstly, the gorge was formed during a lower sea level phase. There is evidence of low sea level on the East Coast during 10,800 ± 155 B.P. (Naidu 1986). Also according to Srinivas Rao *et al.* (1990), and Seetaramaih and Swamy (1994) the sea level was lower by 20 m during 7000-8500 B.P. than the present-day level. This base level change might have resulted in the down cutting of the channel bed by the stream. The narrow and deep walls of the gorge and the form of the gorge have been explained by Wohl and Achyuthan (2001 in press) as related to the induration of the Cuddalore sandstone, which provides a substrate resistant to the local erosion.

The second explanation is that due to stress developed in the deformation of stable continental shelf, reactivation of an ancient fault, or opening of the joint within the rock could have occurred. Such deformation results in response to the compressive stresses transmitted from plate boundaries (Johnston and Kamter 1990). However, presently reported data is too little to suuport any of the above two explanations. Detailed fieldwork and sampling will be carried out in future to solve this problem. The gorge has started to

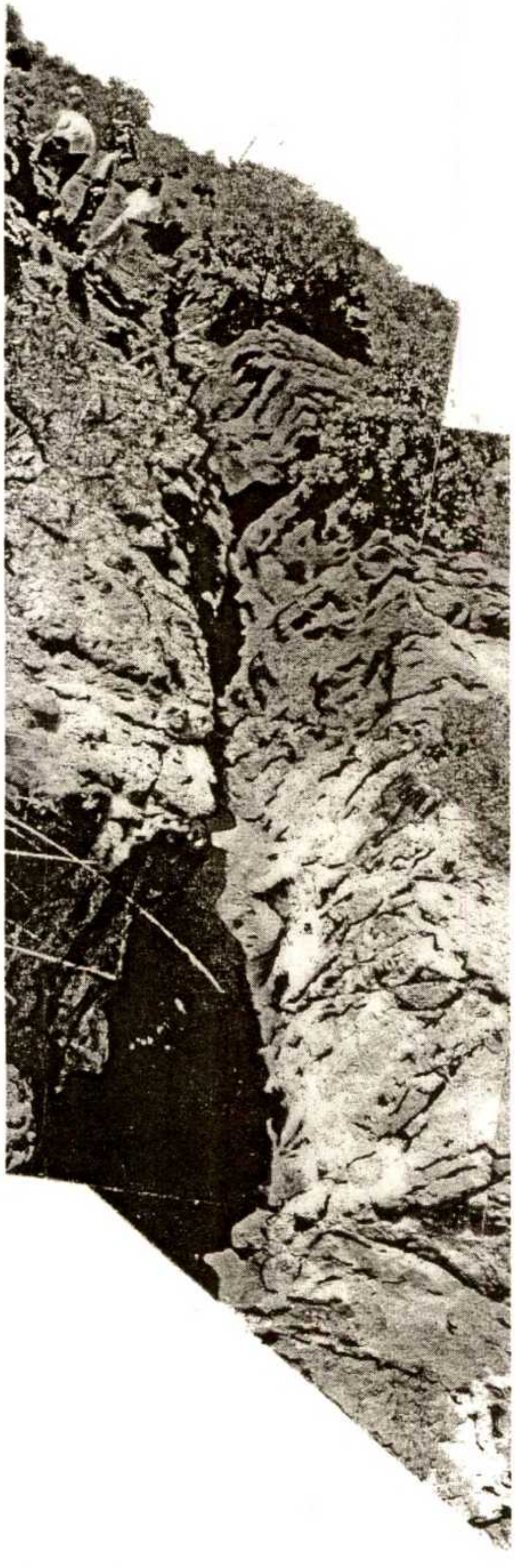

Fig. 2: The gorge near Pondicherry

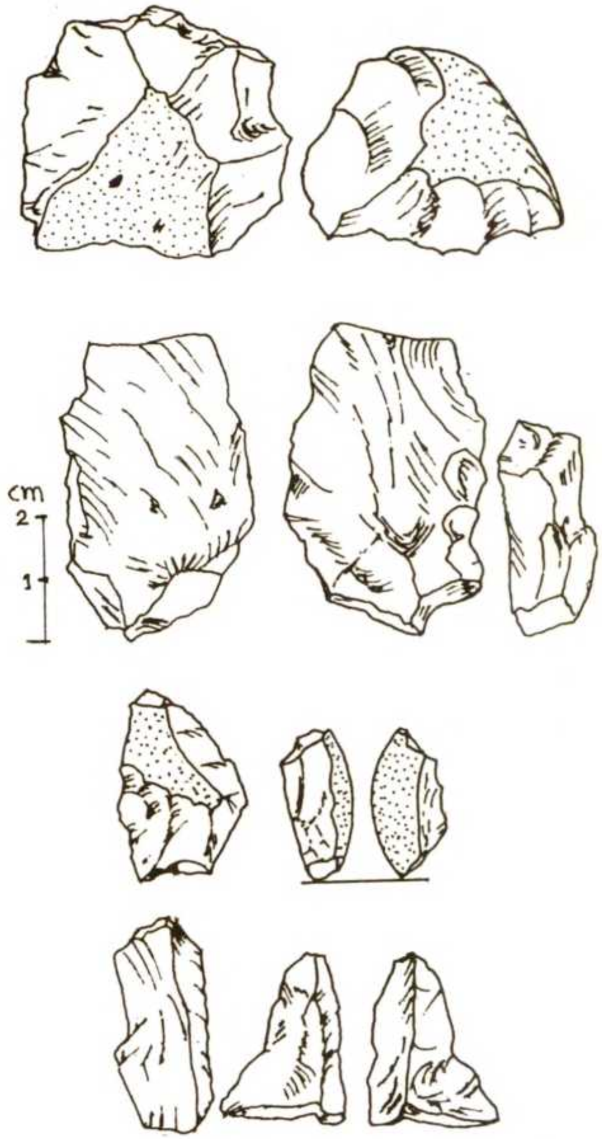

Fig. 3: Microliths collected from the surface near the edge of the gorge

get filled in with the colluvial unit, bearing thick coarse pottery of Megalithic period and microliths, probably after the sea level has risen during the Holocene. This Holocene activity possibly represents a response by the geomorphic systems to fluctuations in climate and sea level.

The differences in the archaeological materials, point to an interesting aspect of this fill is that there have been two distinct phases of colluvial activity. The early phase contains only microliths while the later contains Megalithic pottery. This indicates that localised changes in surface processes may be related to minor environmental changes. However, the pres-

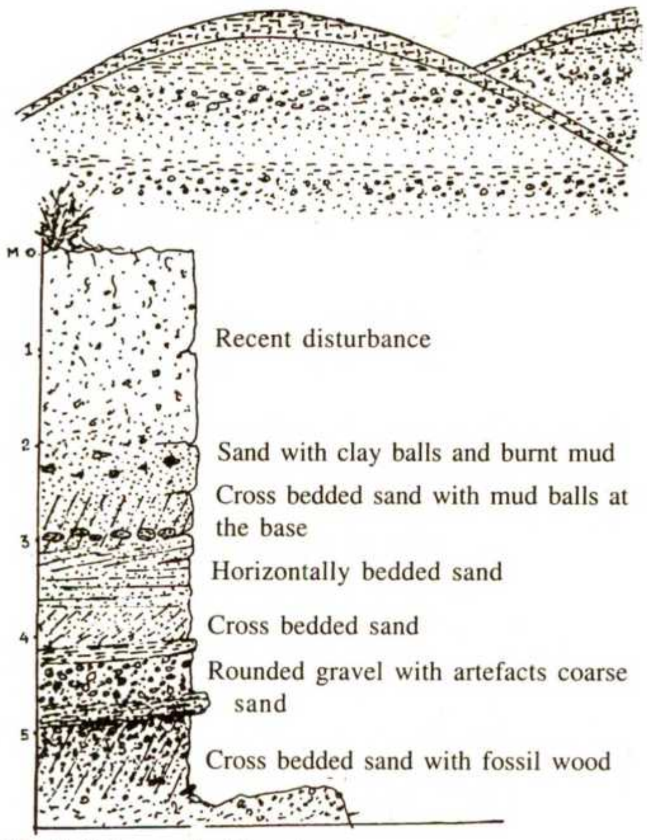
M O
1
2
3
4
5
Recent disturbance
Sand with clay balls and burnt mud
Cross bedded sand with mud balls at the base
Horizontally bedded sand
Cross bedded sand
Rounded gravel with artefacts coarse sand
Cross bedded sand with fossil wood

Fig. 4: Kalapet colluvial section

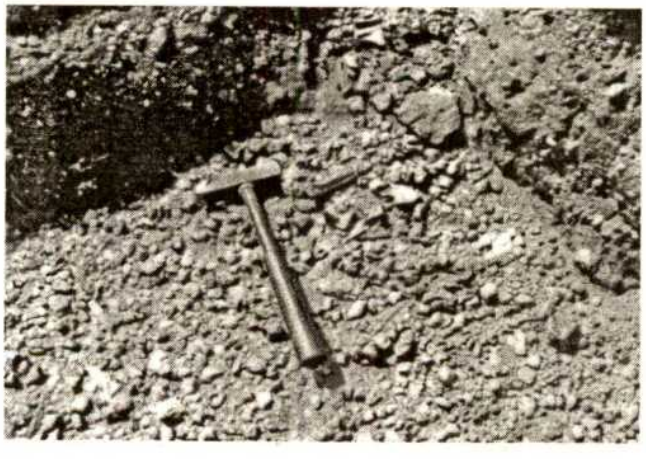

Fig. 5: Gravel yielding artefacts and potsherds

ently reported data is too little to visualise the nature of such changes.

Acknowledgement

We thank Dr. Selva Kumar, Dept. of Archaeology, Deccan College for identifying the Megalithic potsherds.

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Archaeological Re-investigation and Archaeozoology of Seven Southern Neolithic Sites in Karnataka and Andhra Pradesh

Ravi Korisettar, P.P. Joglekar[1], Dorian Q. Fuller[2], and
P.C. Venkatasubbaiah[3]

Department of History and Archaeology,
Karnatak University,
Dharwad, Karnataka

1 Deccan College, Pune

2 Institute of Archaeology,
UCL, 31-34 Gordon Square, London

3 Ramakrishna Vidyalayam,
M.S. Nagar, Kurnool, Andhra Pradesh

Abstract

Archaeological investigations were conducted afresh of seven Southern Neolithic sites in Karnataka and Andhra Pradesh. Archaeozoological evidence is discussed in relation to the plant remains with a view to understand domestic plant and animals in the context of Southern Neolithic culture.

Introduction

Systematic archaeological investigation of the Southern Neolithic has been resumed after several decades of virtual neglect (Korisettar *et al.* 2001). Although several excavations and surveys had been conducted in the region from the 1940s through the early 1970s (e.g. Subbarao 1947, 1948; Allchin 1954,1960, 1963; Sundara 1968; Nagaraja Rao 1962-63, 1971; Nagaraja Rao and Malhotra 1965; Mujumdar and Rajaguru 1966; Ansari and Nagaraja Rao 1969; Paddayya 1973; Rami Reddy 1976), little systematic archaeology was conducted in the region until recent re-investigation and excavation by Paddayya and associates (1992, 1993a, 1993b,1995, 1998; Paddayya *et al.* 1995; Kajale and Eksambekar 1997; Walimbe and Paddayya 1999; Deotare *et al.* 1999), as well as excavations at Watgal (Deveraj *et. al.* 1995; DuFresne *et al.* 1998). These new studies have brought new methodological rigour and research questions to the study of the Southern Neolithic. We began a problem-oriented investigation of selected Neolithic sites with the aim to elucidate subsistence practices and settlement patterns especially as regards the integration of plant and animal components of the economy. While there has long been a growing body of archaeozoological evidence from the Southern Neolithic (e.g. Paddayya 1975; Paddayya *et al.* 1995; Alur 1990; Venkatasubbaiah *et al.* 1992; Joglekar 1999a, 1999b, in press), archaeobotanical evidence has remained meagre (see Kajale 1996; Fuller 2001), so a particular focus was the bulk collection of stratified Neolithic sediments for flotation, which also allowed the systematic recovery of artefactual and bone assemblages through wet-sieving of the heavy fraction. As available results of the ongoing archaeobotanical studies are forthcoming (Fuller *et al.* 2001; Fuller 1999), the present paper focuses on reporting the faunal evidence in its stratigraphic and ecological context.

Sites Explored and Sampled

Systematic sampling was carried out at seven Neolithic habitation sites, including six in the granitic terrain of Bellary district and southwestern Andhra Pradesh, and the site of Hallur (Haveri district) on the banks of the upper Tungabhadra River in the region of the Dharwar greenstone belt (Fig. 1). Although there was some haphazard and casual collection of plant remains no large assemblages were available prior to the current work despite large-scale excavations at Hallur (Nagaraja Rao 1971), Sanganakallu (Ansari and Nagaraja Rao 1969) and Tekkalakota (Nagaraja Rao and Malhotra 1965). These three sites were chosen for the most intensive sampling as previous excavations provided a rich archaeological context in which to place the new investigations. Although archaeozoological evidence had been reported from these sites previously, identification criteria and reporting may not have been to current standards, thus the new archaeozoological data, despite its small sample size, provides some hitherto unavailable information on aspects of the animal economy at these sites.

The previously unexcavated site of Hiregudda (Kupgal hill) located a short distance to the NE of Sanganakallu (Sannarachamma hill) was sampled. In addition the sites of Kurugodu, Hattibelagallu and Velpumadugu, which were known only from survey and unsystematic surface collections, were sampled to provide additional coverage of the wider Neolithic landscape around the Sanganakallu area sites.

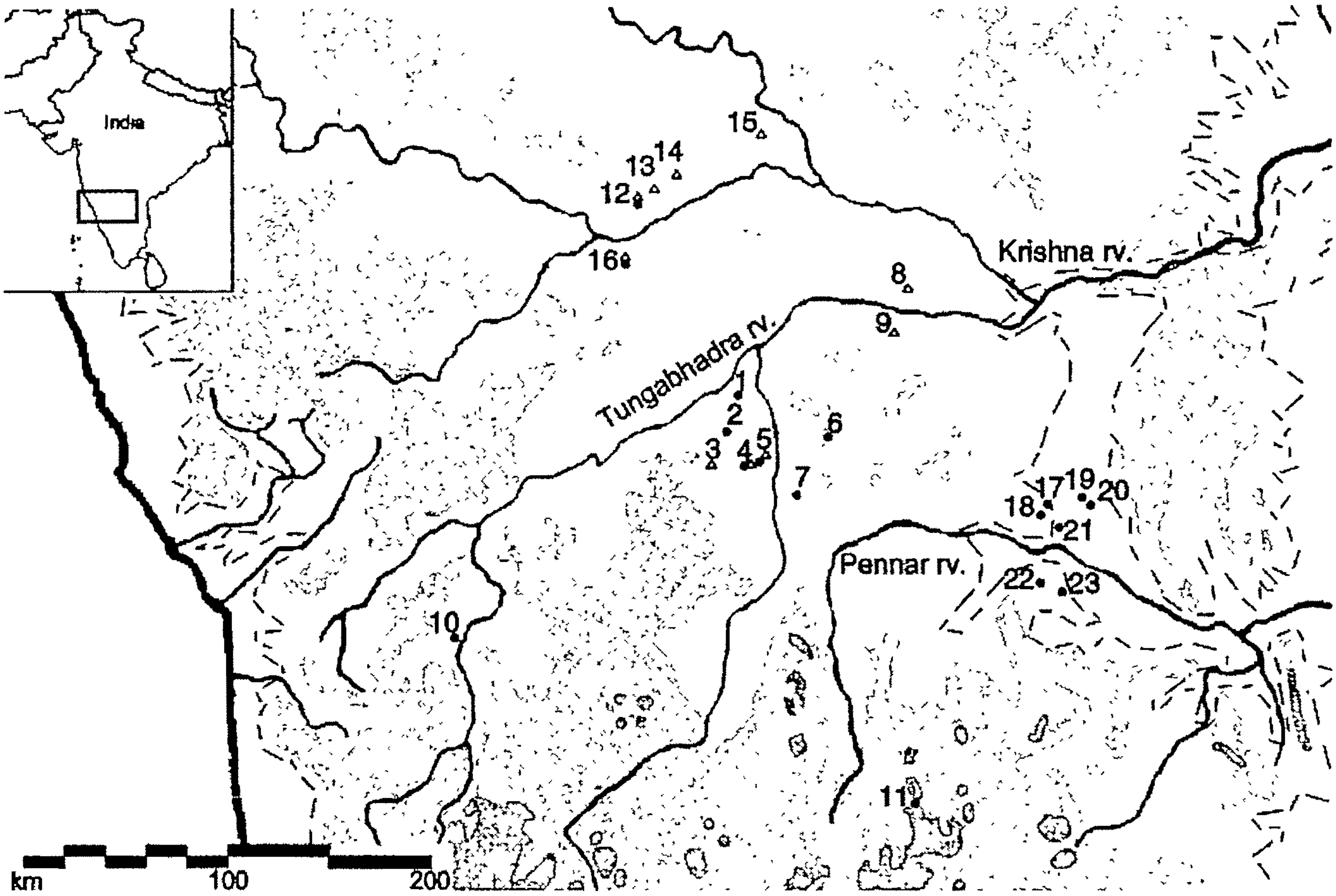


Fig. 1: Map of Southern Neolithic sites discussed in this paper. Open triangles represent ashmound sites. Black circles represent village sites. Site key: 1.Tekkalakota 2. Kurugodu 3. Kudatini 4. Sanganakallu: Sannarachamma hill and Chaudamagudda ashmound 5. Hiregudda and Kupgal ashmounds 6. Hattibelagalu 7. Velpumadugu 8. Utnur 9. Godekal 10. Hallur 11. Banahalli 12. Budihal. 13. Kodekal 14. Malur 15. Kannekolur 16. Piklihal. 17. Jangalapalle 18. Vaddirala 19. Nagarajupalle 20. Peddamudiyam 21.Hanumantaraopeta 22.Inagaluru 23. Balijapalle. Topographic intervals in 1000s of feet.

The general periodization of these finds is clear, although direct radiocarbon dates for the sampled contexts are not yet available. Lithic industry encountered at these sites conforms to that described for the region by Nagaraja Rao and Malhotra 1965while the ceramics can be fit into the typology of Allchin (1960, 1963) and previous excavations. A relative chronology of the Southern Neolithic, focusing in particular on pottery, has been outlined by Allchin and Allchin (1982), and on this basis all of the layers sampled from the sites described below should probably be attributed to Phases II and III. While Phase I was reported from the excavations at Hallur (Nagaraja Rao 1971), the section scraped and sampled by us did not yield deposits that can be clearly attributed to earlier than Phase II. The three phase relative chronology can be more accurately dated by correlations with the calibrated radiocarbon chronology from Watgal (Deveraj *et al.* 1995; Korisettar *et al.* 2001), and indicates that Phase II dates to ca. 2200 cal.BC to 1800 cal.BC, while Phase III begins ca. 1800 cal.BC with a still poorly defined ending point that is probably 1200-1000 cal.BC with the emergence of the Megalithic phase.

Sanganakallu (SGK)

The village is situated 5 km northeast of Bellary, the district headquarters. Sannarachamma hill, Hiregudda, Chaudammagudda constitute a chain of granite hills to the north of the village on top which the archaeological sites are situated (Fig. 2). Of these, Sannarachamma hill was excavated earlier (Subbarao 1947,1948; Ansari and Nagaraja Rao 1969). The excavations here have revealed evidence for Phases II and III of Allchin and Allchin (1982). The complex of hills is surrounded by a rolling plain characterized by a savanna environment with the *Acacia-Albizia amara* vegetational series, although most of the region is now under cultivation. The local soil on the plains range from reddish to light/

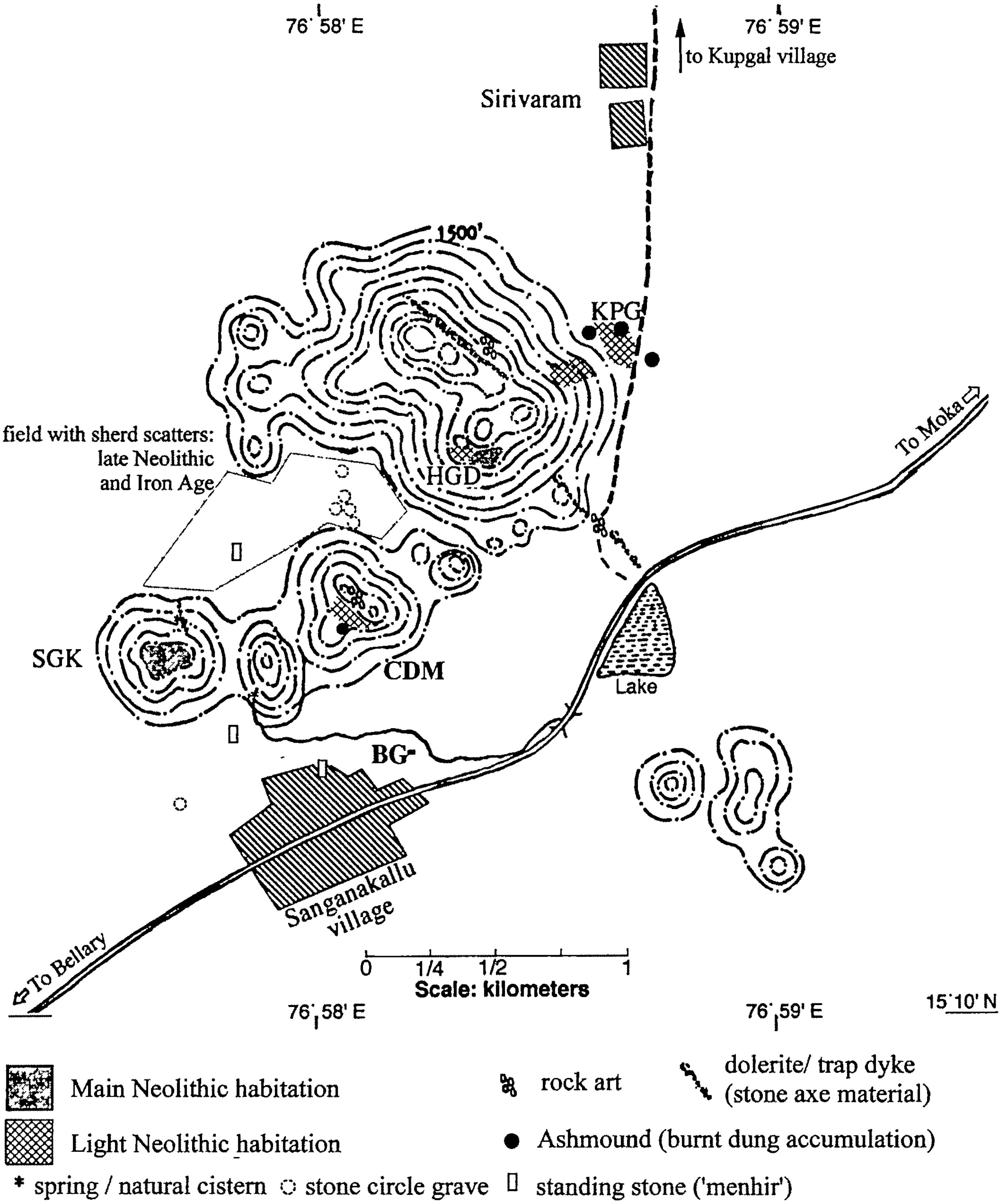


Fig. 2: Map of archaeological sites in the vicinity of Sanganakallu village. The current project has recovered archaeobotanical and archaeozoological remains from Sannarasamma hill (SGK) and Hiregudda (HGD). Other sites indicated: Choudammagudda (CDM), Kupgal ashmounds (KPG) and Banglatota (BG). Additional archaeological evidence plotted on the basis of Subbarao (1947) and/or this project.

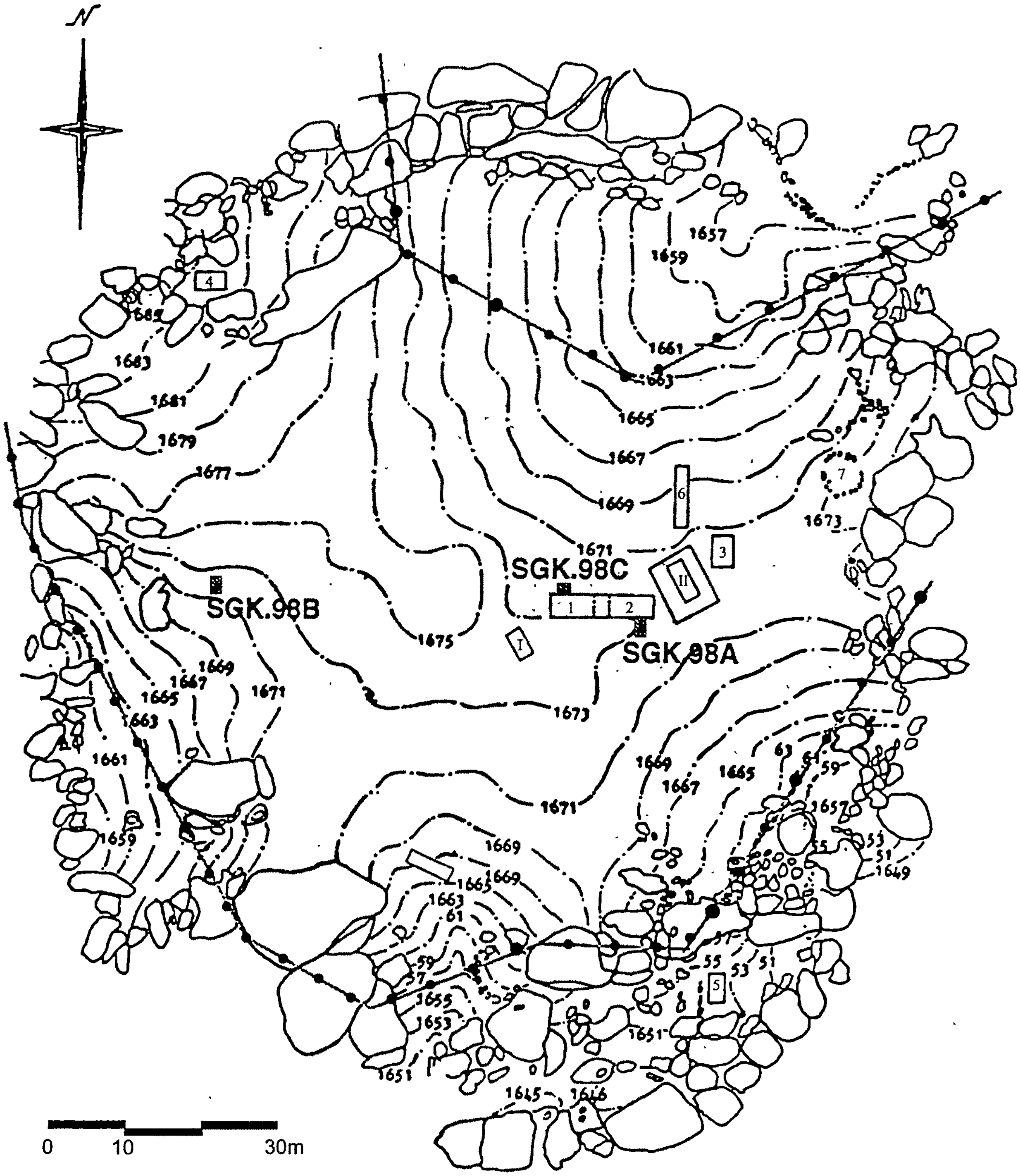


Fig. 3: Plan of Sannarachamma hilltop (after Ansari and Nagaraja Rao 1969), indicating sampling loci of current project in relation to early sampling by Ansari and Nagaraja Rao (Arabic numerals) and Subbarao (Roman numerals). Approximate extent of summit edges and site destroyed by granite quarrying of the hillsides indicated by beaded lines.

medium black soil and is derived from the granite. Neolithic habitation deposits on the Sannarachamma hill is the largest and occupies a flat terrace on top of the hill encircled by granitic tors. Towards the west of the cluster of ashmounds there is evidence for less intense occupation, which includes a number of stone built structures with ground stone tools and occasional pottery, the habitational soil being very thin.

There is an extensive dyke running through Hiregudda and there is evidence for the manufacture of flaked and ground stone tools from this dolerite rock. In addition there are numerous rock bruisings on the dyke. The depictions include cattle and human figures (see Gordon 1951; Allchin and Allchin 1995). There is a group of three ashmounds at the eastern foot of Hiregudda, known as Kupgal ashmounds (Mujumdar and Rajaguru 1966).

The other hilltops also have Neolithic sites. On the Choudammagudda hilltop there is a large scatter of Neolithic surface finds on the artificial terrace surfaces. There is also a small denuded ashmound situated at the shoulder of the hill overlooking the village of Sanganakallu. This appears to have been sporadically occupied and may have been a seasonal occupation. On Hiregudda hill there is an area of deeply stratified cultural deposit (Fig. 1), west of this area were light scatters of lithics and pottery.

Sampling on Sannarachamma Gudda: Samples for flotation and wet sieving was collected in 1998 from three localities. 98A, constituted cleaning back of the exposed, heavily eroded section of what had been the south wall of Ansari and Nagaraja Rao (1969) Trench 2. Two 1 m square pits aligned north-south were dug. The northern wall of these was dug through intact deposits beneath the eroded fill of the old trench, while the other was dug south of a baulk and preserved a complete stratigraphic sequence, although it was excavated only to Layer 7 (Fig. 3). In this area the underlying bedrock was reached at 2.5 m. Samples for flotation were collected from all layers, although layers 4-5 and 7-8 were lumped in some samples. Phytoliths were also collected through the sequence.

98B was a 1.5 m E-W by 2 m N-S trench on the western portion of the hilltop deposits. It was dug to a depth of approximately 1.5 m without exhausting the archaeological deposits. Samples were taken from each layer as well as distinct horizontally differentiated contexts in the lower portion of the pit. Phytolith samples were also collected.

98C was a section cleaning, 1 m wide section, 1.75 m deep, on the north wall of Ansari and Nagaraja Rao (1969) Trench 1. Three layers were preserved, flotation samples were taken from the lower two of these while phytolith samples were taken from all three. Flotation samples yielded few plant remains and the consistency of the sediments was similar to reddish brown layer preserved at ashmounds suggesting that these contexts may have been derived partly or entirely through cattle dung (unburnt). These samples are poor in charred plant remains.

Faunal remains were recovered from loci SGK.98A and 98B (Fig. 4), with the majority coming from upper levels (Layers 1-4) at both loci and thus dating to Phase III of Southern Neolithic with much less material from Phase III (represented by SGK.98B.6-7, SGK.98A.7 and SGK.98A.10). The identifiable specimens by taxon are shown in Table 1. The larger sample size from Phase III includes evidence for the hunting of wild taxa, including deer, antelopes and water buffalo. Also of note is the evidence for a fresh water mussel (*Parreysia* sp., family *Unionidae*) because Sanganakallu is not located near a watercourse. Were mussels sometimes transported from the nearest seasonal river, the Hagari, some 10 kilometers away? Some additional small bones were recovered in flotation samples, probably mostly of rodents but including one possible fish bone, which are not included in the totals here.

Table 1: Faunal remains from Sannarachamma (Sannarasamma) hill

Taxon	**Surface**	**Phase III**	**Phase II**	**Total**
Bos indicus	1	3	1	5
Bos/Bubalus	0	8	2	10
Bubalus bubalis	0	1	0	1
Capra hircus	1	0	0	1
Capra/Ovis	0	2	0	2
Antilope cervicapra	0	1	0	1
Cervus sp.	0	1	0	1
Axis axis	0	1	0	1
Rat/Rodent	0	2	0	2
Parreysia sp.	0	1	0	1
Total NISP	2	20	3	25

There were 16 unidentifiable fragments.

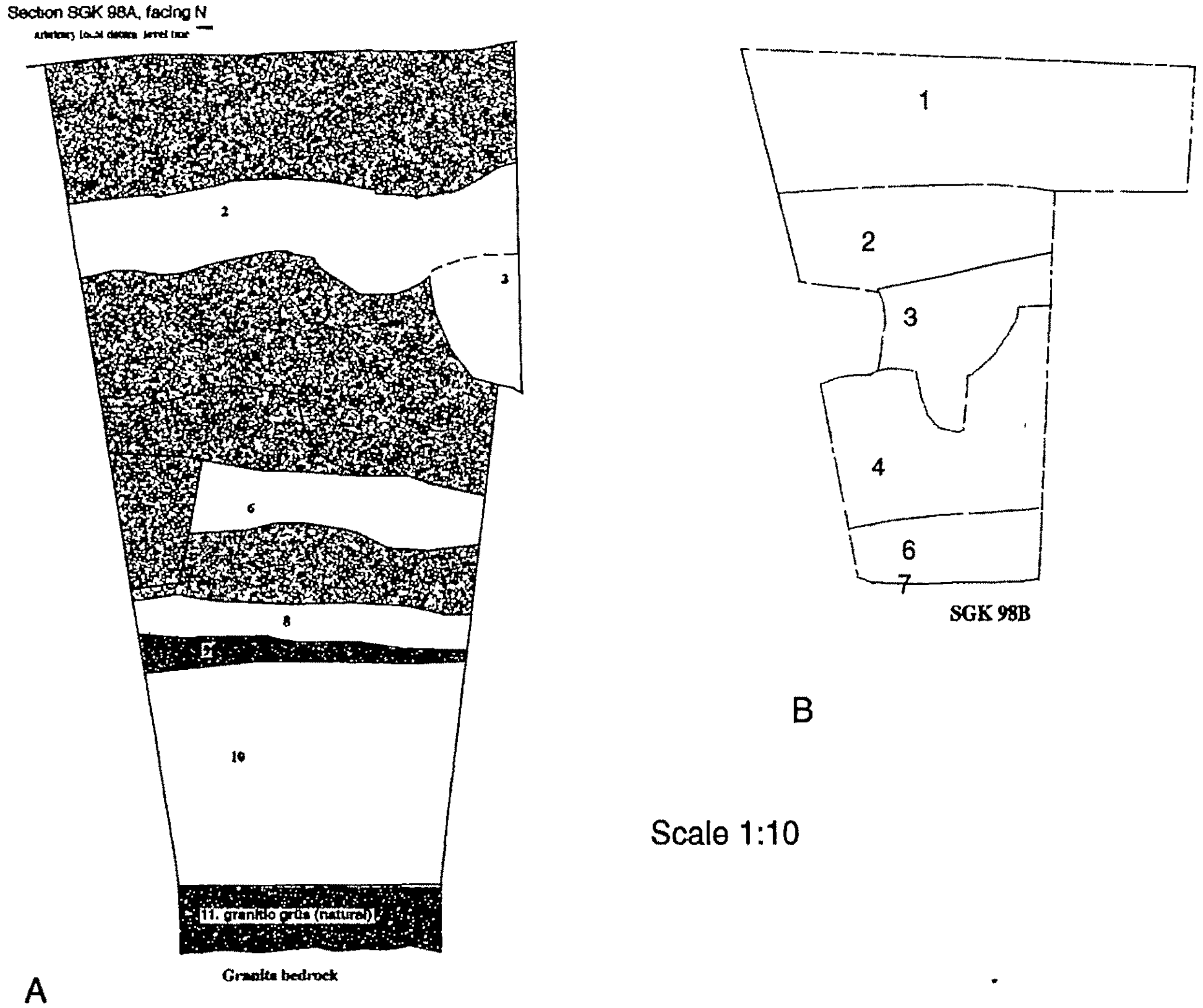

Section SGK 98A, facing N
arbitrary local datum level line
2
3
6
8
10
11. granito grüs (natural)
Granite bedrock
A
1
2
3
4
6
7
SGK 98B
B
Scale 1:10

Fig. 4: Stratigraphic profiles for the sample tenches SGK.98A and SGK.98B on Sanarachamma Hill

Sampling on Hiregudda: A single, south-facing 1 m section was cleaned on the northern side of the large pit opened by villagers who were destroying the site for plastering material (HGD.98A). From the topsoil to bedrock was a depth of 1.9 m, and seven layers not including the topsoil were recorded. Most of the layers were in the brown-grey spectrum typical of habitation layers at other hilltop sites, and yielded plant remains on flotation. Layer 4 was a lens of reddish sand; Layer 7 was a compact ashy white-grey layer, interpreted as derived from dung ash. The archaeological deposits probably belong to Phases II-III. The few identifiable bones recovered are shown in Table 2.

Table 2: Faunal remains from Hiregudda

Species/Layer	(2)	(4-5)	Total
Bos indicus	2	0	2
Rat/Rodent	0	1	1
Total NISP	2	1	3

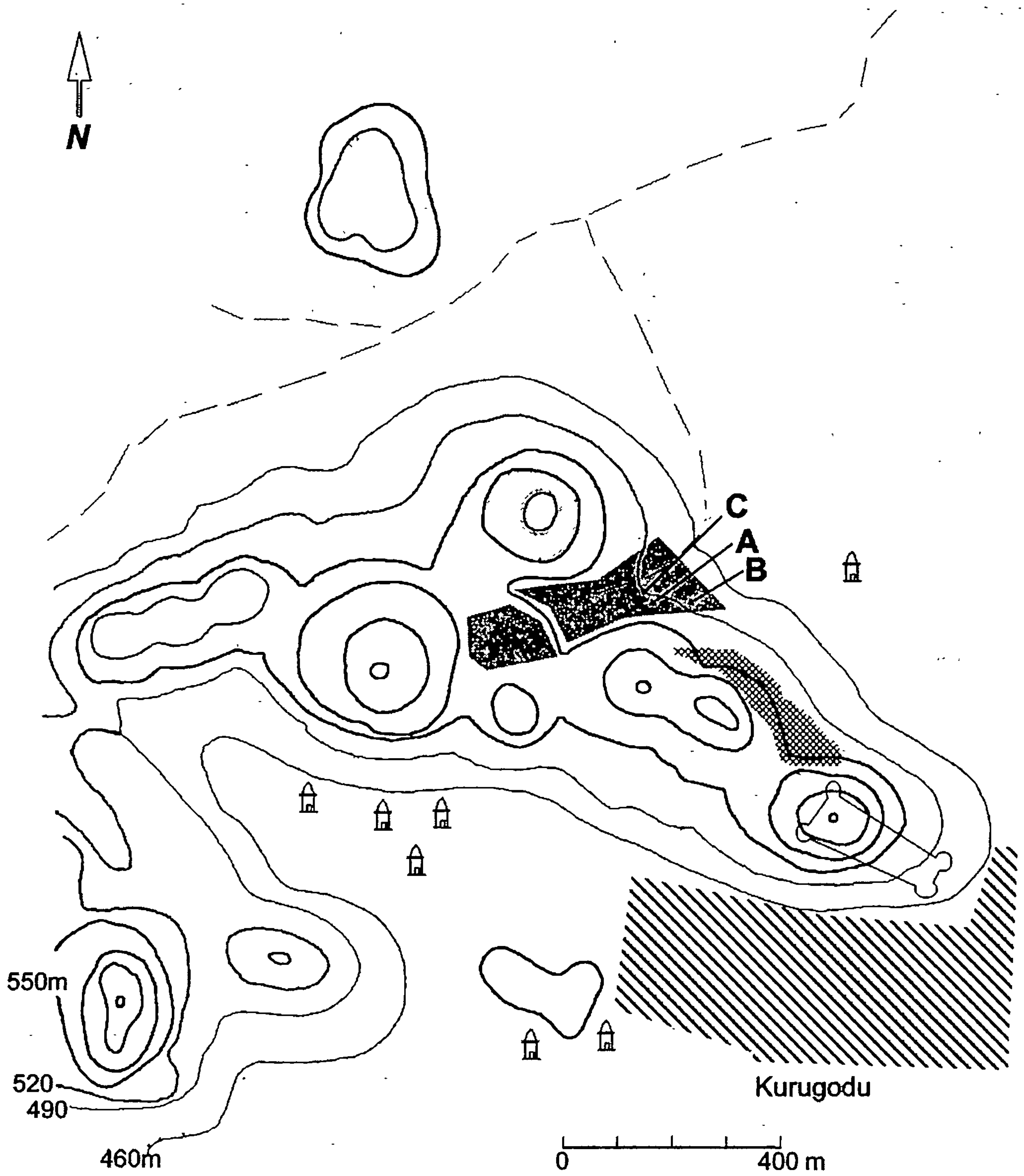


Fig. 5: Schematic plan of Kurugodu Neolithic site. Main stratified Neolithic remains indicated in grey, although lower, eastern portion had been largely destroyed by quarrying by 1998. Location of sampling localities indicated by arrows. Location of remnants of ashmound deposits indicated by black circle. Sparse evidence for Neolithic activity, including grinding hollows in boulders and scattered pottery indicated by cross-hatching. Modern village of Kurugodu indicated by heavy hatching. Locations of historical temples around the hill indicated, as is the approximate outlines of the medieval fortification on the eastern summit of the hill.

Kurugodu (KRG)

The village of Kurugodu is situated 24 km northwest of Bellary off the Bellary BSiraguppa road. The Neolithic deposits are found at the foot of the hill within the saddle at the eastern end of the granite hill and on the northern edge of the village (Fig. 5). Although the Neolithic deposits were found to extend upslope of the saddle the present investigations were conducted at the base of the hill. The local people have quarried much of the archaeological deposits. Evidence for an ashmound is attested by grey-brown ashy layers like those at Kupgal 1. Neolithic, Iron Age and Early Historic pottery types are found on the surface. The environmental setting is similar to Sanganakallu area with a savanna landscape dotted by the *Acacia-Albizia amara* vegetational series.

Sampling: Stratified deposits were found to be intact against the southern extension of the hill, and 2 localities were sampled (Fig. 6). A fairly long intact sequence (six levels) was cleaned and sampled (KRG.98A). Two additional sets of samples were taken from the archaeological sediment between two boulders further east along the south side of the valley (KRG.98B). Locality 98C is intact beneath the central area disturbed by granite quarrying. The archaeological deposits probably belong to Phases II and III.

Table 3: Faunal remains from Kurugudu.

Species/Layer	(1)	(2)	(3)	(4-5)	Total
Bos indicus	03	01	00	01	05
Bos/Bubalus	09	04	02	04	19
Bubalus bubalis	00	00	00	00	00
Capra hircus	00	01	02	00	03
Capra/Ovis	02	00	00	00	02
Capra/Ovis/Antilope	04	05	00	03	12
Antilope cervicapra	01	00	00	00	01
Axis axis	00	00	01	00	01
Total NISP	19	11	05	08	43

There were 42 unidentifiable fragments.

Hattibelagallu (HBG)

The village of Hattibelagallu is situated on the Bellary Balur road about 30 km northeast of Bellary in the Alur taluk of Kurnool district, Andhra Pradesh. The environmental setting is similar to the Sanganakallu area of Bellary and is covered by the savanna *Acacia-Albizia amara* vegetational series. We investigated this previously unexcavated site and a series of test pits were dug in the archaeological deposit situated half a kilometer south of the village of Hattibelagallu. Surface collection of Neolithic material was first made by Foote (1895) and later by Rami Reddy (1978). Nearby digging by the villagers has destroyed the site, however, 3 intact localities were selected for sampling. The Neolithic deposit from this site could be placed in the Phase II of the Southern Neolithic. There is no evidence for an ashmound in the vicinity of the site. In the destroyed area of the site a few fragments of scoriacious ashmound like material was noted suggesting that there may have been an ashmound here or in the vicinity.

Sampling: The archaeological site has been greatly damaged as the villagers have extensively dug it out. Some of the lower portions of the site were still intact and a section of this was cleared and sampled on the southwest portion of the site (HBG.98A). In addition, two sections on the edges of the disturbed area, on the western end of the site preserved 80 cm to 1 m of intact stratified deposits. Two other sections were cleaned, HBG.98B and HBG.98C. A third sample was taken from the preserved section at the west end of the site. Of interest is the occurrence of river mussel in the latest level at this site, similar to the evidence from Sanganakallu. This site is about twice as far as Sanganakallu from the Hagari river, the closest potential source.

Table 4: Faunal remains from Hattibelagallu, locus HBG.98A

Species/Layer	(C-1)	(A-2)	(A-3)	Total
Bos indicus	03	01	01	05
Bos/Bubalus	00	05	01	06
Parreysia sp.	01	00	00	01
Total NISP	04	06	02	12

Tekkalakota (TKT)

The village of Tekkalakota is situated on the Bellary-Siraguppa road about 8 km south of Siraguppa. The environmental setting of the region around Tekkalakota is the *Acacia-Albizia amara* vegetational series. This is yet another hilltop settlement (Fig. 7) previously excavated (Nagaraja Rao and Malhotra 1965) with evidence of Neolithic Phase II and continuing into Phase III but apparently not persisting to end of that Phase. Other evidence included numerous urn burials,

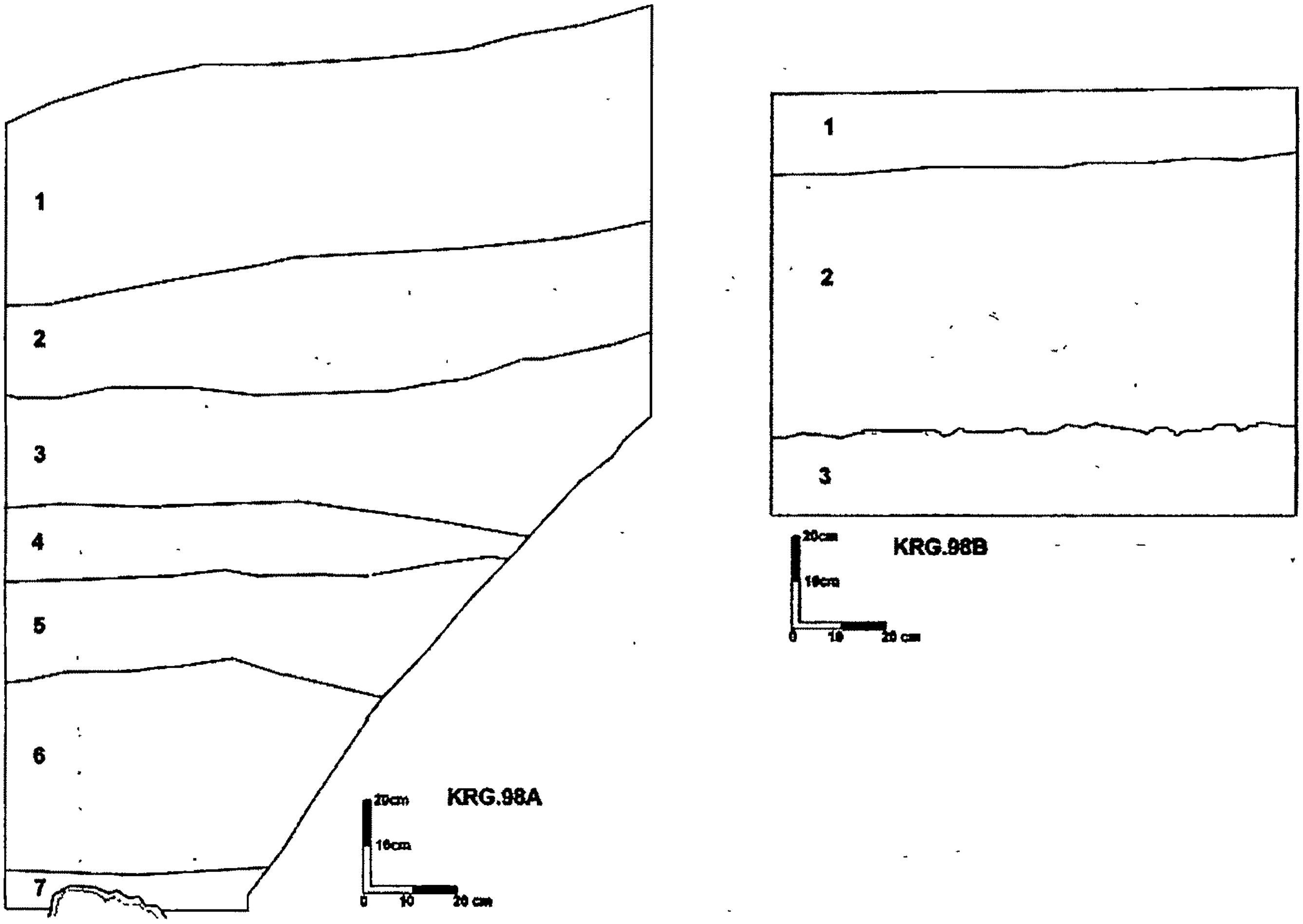


Fig. 6: Stratigraphy of sampled localities at Kurugodu, layer descriptions as follows: KRG.98A, section facing west, 1. Light brownish grey (5YR 4/1), heavily rooted soil, includes much pottery; 2. Ashy, grey layer (5YR 8/1), ashier than below (dung-derived?); 3. Light pink-white-grey (5YR 8/1), compact (dung-derived?); 4. Silty and very fine sandy sediment with ashy content, brownish-grey (5YR 4/1); 5. . Light pink-white-grey (5YR 8/1), compact (dung-derived?); 6. Silty and very fine sandy sediment with ashy content and visible charcoal, brownish-grey (5YR 4/1); 7. Brown granitic gruss; KRG.98B, section facing northeast: 1. A light grey (5YR 8/1), compact and clayey layer (dung-derived?); 2. Heavier, and less compact than above, silty clay, light brownish grey (5YR 4/1), including some charcoal; 3. Dark brown granitic gruss.

posthole defined outlines of houses, lithic and copper artefacts and the standard varieties of pottery.

Sampling: Baulks of previously excavated trenches at Locality 1(Nagaraja Rao and Malhotra 1965) were re-examined and selected sections were cleaned to expose the intact deposits for collecting sediment samples for flotation (Fig. 8). TKT.98A and TKT.98B (Fig. 7-8) were dug into TKT-1 of Nagaraja Rao and Malhotra (1965). Additional sequences were also dug: TKT.98C (older TKT-5) and TKT98.D (without number in the previous publication), which had the longest sequence of layers.

The faunal assemablge was dominated by cattle, followed by sheep/goat, and some wild fauna. Of particular significance is evidence for exploitation of freshwater resources, including indeterminate ones. Fish and the river mussel (*Lamellidens* sp.) were most likely collected from the Tungabhadra River, 6 km to the west. This evidence comes from the upper two layers, which may date to terminal Phase II or Phase III.

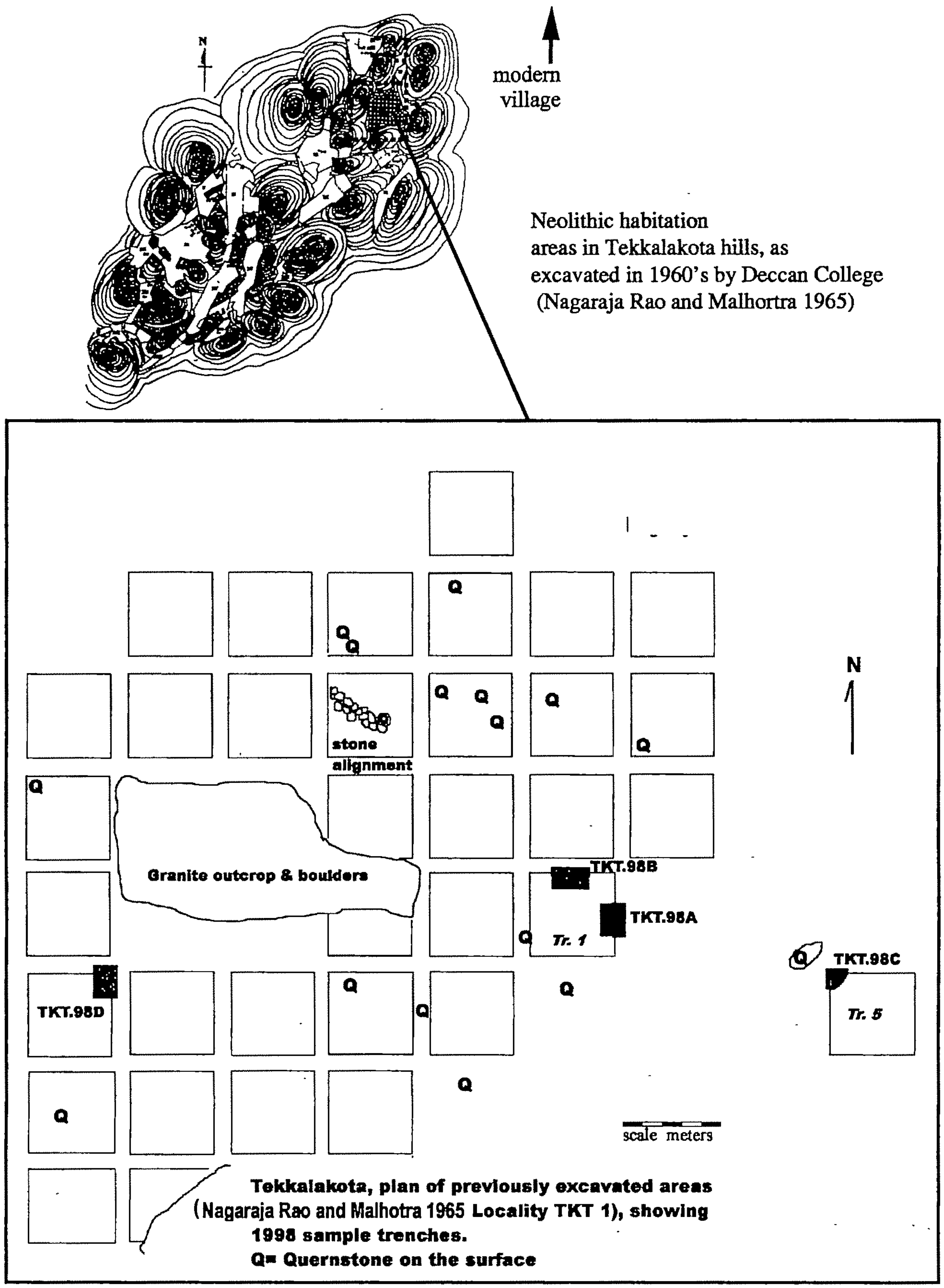

N
modern village
Neolithic habitation areas in Tekkalakota hills, as excavated in 1960's by Deccan College (Nagaraja Rao and Malhortra 1965)
N
Q
stone alignment
Granite outcrop & boulders
TKT.98B
TKT.98A
Tr. 1
TKT.98C
Tr. 5
TKT.98D
scale meters
Tekkalakota, plan of previously excavated areas (Nagaraja Rao and Malhotra 1965 Locality TKT 1), showing 1998 sample trenches.
Q= Quernstone on the surface

Fig. 7: Plan of Tekkalakota, indicating sampling localities in relation to earlier excavation grid of Nagaraja Rao and Malhotra (1965)

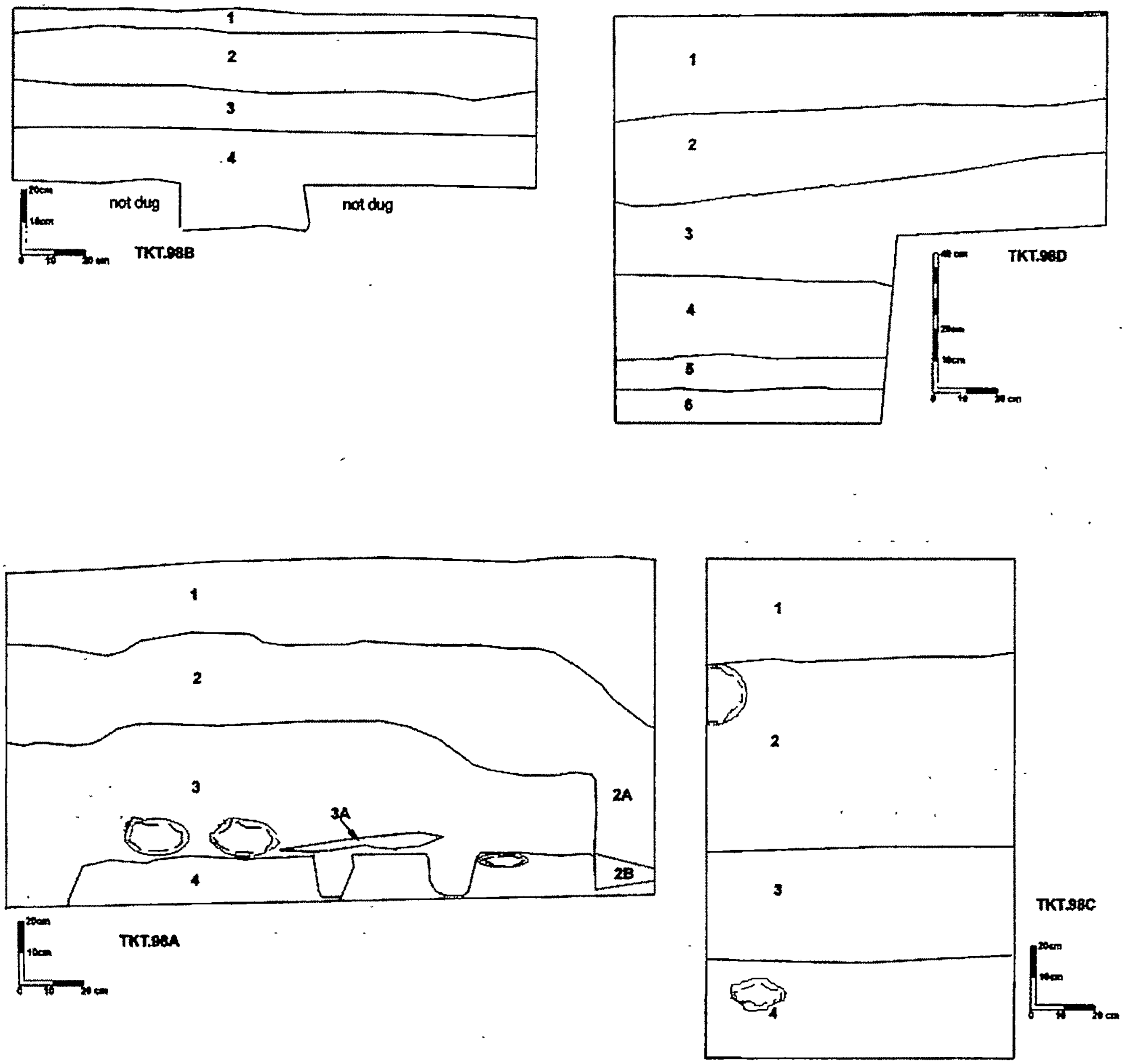


Fig. 8: Stratigraphy of sampled sections of Tekkalakota, layers descriptions as follows: TKT.98A, section facing west, 1. Top soil, heavily rooted, fine sandy humous (10YR 3/2); 2. Silty clay with some medium to fine sand (5YR 6/1); 2A. Upper pitfill from layer 2; 2B. Lower pitfill resembles layer 3; 3. Clayey sily, more yellowish than above (10YR 6/1-6/2), with large granite stone inclusions; this layer fills postholes dug into underlying deposit; 3A lense of pinkish-brown silty deposit (5YR 6/4); 4. Red, granitic, medium sand apparently sterile, overlying granitic bedrock of greyish granite (this layer does not appear to be natural gruss and may have been transported from surrounding plains); TKT.98B, layers equivalent to the same in 98A; TKT.98C, section facing south, layers 1-4 as in 98A.1; TKT.98D, section facing west: 1. Top soil, as layers 1, above; 2. Loose, silty grey sediment (5YR 6/1); 3. Silty, yellow-brown grey (10YR 6/2), includes large burnt clay fragments and calcrete nodules; 4. Silty, grey (5YR 6/1); 5. Similar to above but different shade (10YR 6/1); 6. Red-brown sand (5YR 4/4), coarser than that in TKT.98A, apparently sterile.

Table 5: Faunal Remains from Tekkalakota.

Species/Layer	(2)	(3)	(C4)	(D5)	Total
Bos indicus	03	02	02	01	08
Bos/Bubalus	10	08	03	00	21
Bubalus bubalis	00	01	00	00	01
Capra hircus	00	00	01	00	01
Capra/Ovis	04	02	01	00	07
Boselaphus tragocamelus	00	02	00	00	02
Sus scrofa	00	01	00	00	01
Rodent/Rat	00	02	02	01	05
Fish (medium: fresh)	00	02	00	00	02
Lamellidens sp	01	00	00	00	01
Total NISP	18	20	09	02	49

Due to their probable equivalence and small sample sizes, layers 2 and 3 have been grouped across loci. Layers C4 and D5 both clearly predate layers 2 and 3, but the relative chronological relationship between these layers is uncertain.

Velpumadugu (VPM)

The village of Velpumadugu is situated 18 km south-east of Bellary town on the Bellary-Anantapur road and about 14 km north of Uravakonda, a taluk headquarters in the Anantapur district of Andhra Pradesh. The village is about 3 km south-east of Vidapanakallu. Both Vidapanakallu and Velpumadugu are hilltop Neolithic settlements known from previous surveys (Foote 1887; Rami Reddy 1978), especially the latter is well-known for the rock bruisings of cattle, which represent a breed ubiquitous to all the Neolithic sites of the Southern Neolithic province as well as representation of possible *Bos gaurus*. There is yet another site towards the south, which is in a disturbed condition owing to digging by the local people. The sites are located in a savanna environment classified in the *Acacia-Albizia amara* vegetational series. Two test pits were dug into the cultural deposit enclosed by granitic tors atop the hill to the east and south of the village. There is no evidence for an ashmound in the vicinity of the site. Local diggers had largely destroyed a second locality of Neolithic material on a more southerly ridge on the same hill.

Sampling: A single sample locality was chosen and a 1.5 x 1 m pit was dug. It revealed four layers above the bedrock to a total depth of 90 cm. Beneath the topsoil was a compact grey layer that appeared to be derived from dung. Beneath this was a looser grey layer, which overlay a brown horizon thought to be natural soil. Flotation samples were collected from all the three layers, although their yields were poor.

Faunal Remains from Velpumadugu: Only one *Bos indicus* astragalus has been found.

Palavoy (PVY)

The village of Palavoy (Palavoyi) is situated in the Kalyandurga taluk of Anatapur district and is about 40 km south of Bellary-Sanganakallu complex of sites. It is a Neolithic site of the Ashmound Tradition situated about 2 km south of the village. A cluster of three ashmounds are located at the western foot of the large granitic inselberg, previously investigated by Rami Reddy (1976, 1978) who assigned the ashmounds to the Iron Age, although this date is not substantiated by other ashmound investigations in the Southern Neolithic province (Paddayya 1993; Korisettar *et al.* 2001). Environmental setting of the site is similar to the Bellary savanna environment classified in the *Acacia-Albizia amara* vegetational series.

Sampling: Two test pits were dug east of the central ashmound. The first test pit 98A was placed 12 m east of the base of the obvious mound. It reached natural soil at a depth of 85 cm, including two archaeological layers below the topsoil. The second pit 98B was a further 15 m east, and reached natural soil at a depth of 120 cm including three layers below the topsoil. Much of the sediment in both pits appeared to be ashy and derive from burnt dung with some admixture of habitational refuse in the form of pottery but virtually no charcoal. Flotation failed to produce assemblages here.

Table 6: Faunal remains from Palavoy

Species/Layer	(2)	(A3)	(D3-4)	Total
Bos indicus	03	00	01	04
Bos/Bubalus	05	01	01	09
Bubalus bubalis	00	02	02	04
Capra/Ovis	00	01	00	01
Antilope cervicapra	00	00	01	01
Total NISP	08	04	07	19

Layer 2 from pits 98A and 98B have been combined, while the lowermost layers from 98B have been combined but separated from layer 3 of 98A.

Hallur (HLR)

This site is located on the west bank of the upper Tungbhadra river in the undivided Dharwad district, now in the Hirekerur taluk of Haveri district (Fig. 9). Today this region is located in a zone classified as potentially Dry Deciduous forest but fairly near the gradual westwards transition into the Wet Deciduous zone. The site was first recorded and excavated by Nagaraja Rao (1962-63, 1971) along with several other Neolithic and Iron Age sites in the Tungabhadra valley. The archaeological sequence at the site ranges from the Neolithic to the Medieval. Quarrying activity of the villagers is destroying the northern end of the site and sections near the banks of the river. Between 1998 and 2000 at the site a large portion of the deposit has been quarried out. Our investigations at the site were restricted to sampling the Neolithic horizon (see indication on Fig. 9) which unconformabliy overlies the alluvial floodplain of the Tungabhadra.

Sampling: A section on the northeast side of the site on the river was being dug out by the villagers. This had exposed the Neolithic sequence. This section was cleaned up and sampled (HLR.98A, Fig. 10). Adjacent to the sampled section, equivalent to its uppermost levels, was a charcoal lens, which was sampled in bulk as HLR.98B. Two more sections were scraped and sampled in the central part of the mound (HLR.98C and HLR.98D). The faunal material discussed here comes from HLR.98A

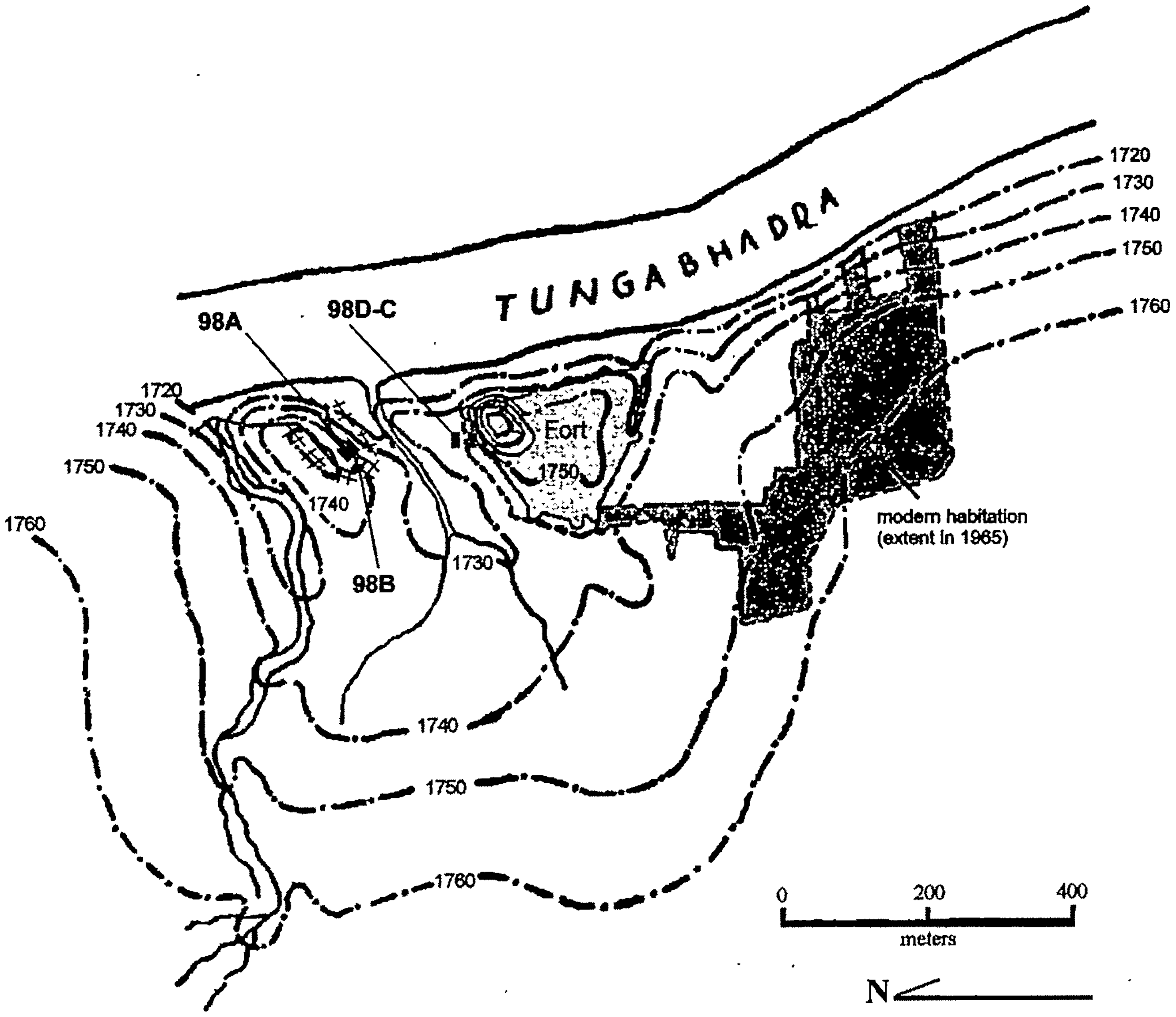
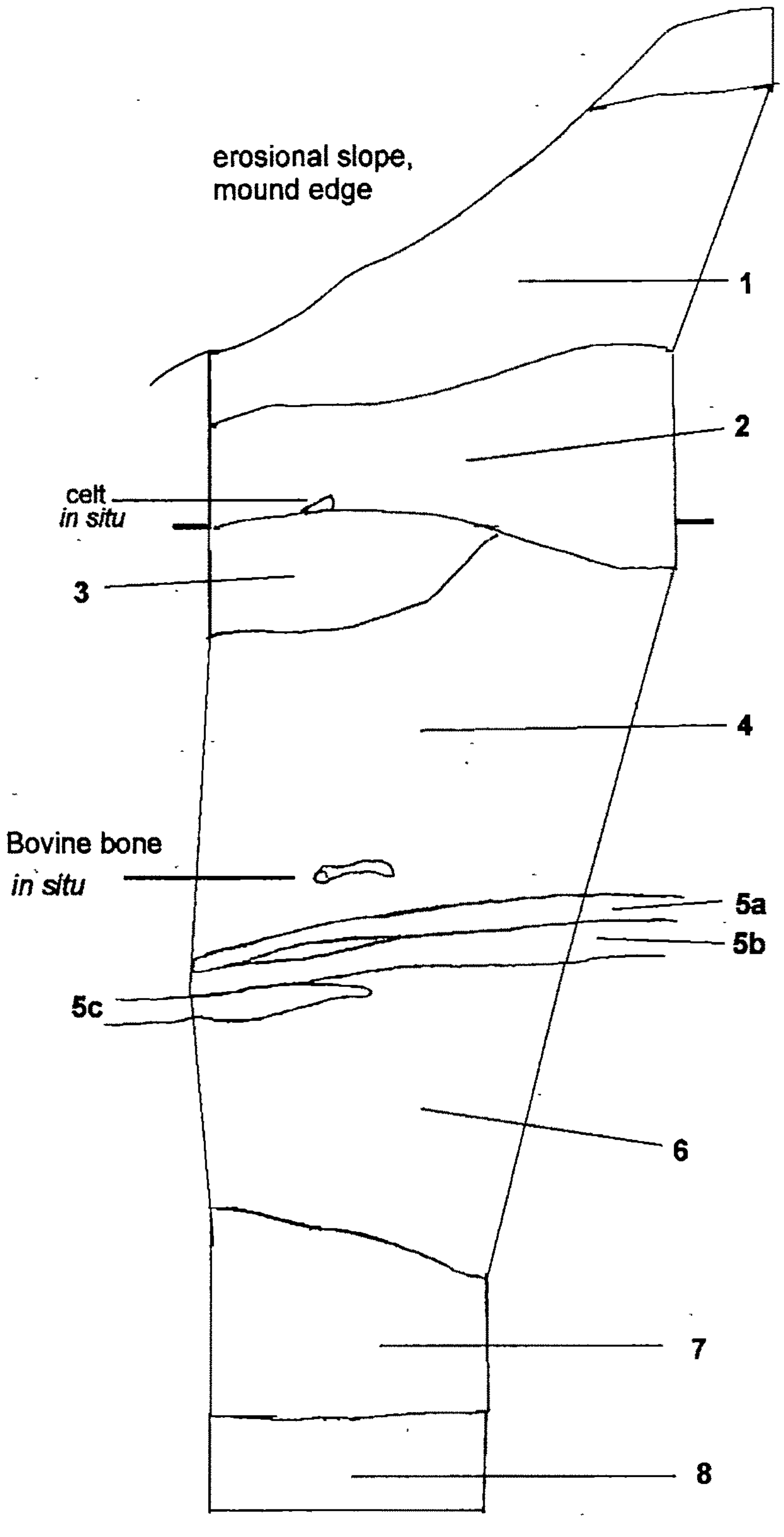


Figure 9. Plan of Hallur archaeological site (after Nagaraja Rao 1971), indicating 1998 sampling localities. Approximate location of exposed sections due to destructive digging by villagers on northern end of the site indicated by solid grey line (1998) and by hatched line (2000).



West-facing section at Hallur, sampling site 98A. Scale 1:20

Fig. 10: Stratigraphic section of sampling locality HLR.98A. Most layers consisted of silt rich, grey-brown anthropogenic layers, differentiated on the basis of minor differences in colour and texture. Layers 5a, 5b, 5c represent thin lenses of schist flakes. Similar levels excavated by Nagaraja Rao (1971) were interpreted as floor levels. It may be that schist was used to level surfaces prior to plastering with a softer material.

Table 7: Faunal remains from Hallur (HLR.98A)

Species/Layer	**(0)**	**(3)**	**(4)**	**(6)**	**(7)**	**(8)**	**Total**
Bos indicus	00	01	06	02	00	01	10
Bos/Bubalus	02	03	15	00	02	05	27
Bubalus bubalis	00	00	00	00	00	00	00
Capra hircus	01	00	01	00	00	00	02
Capra/Ovis	00	00	01	00	02	00	03
Capra/Ovis/Antilope	00	00	00	01	00	00	01
Boselaphus tragocamelus	00	00	01	00	00	00	01
Antilope cervicapra	00	01	00	00	00	00	01
Lepus sp.	00	00	01	00	00	00	01
Lamellidens sp.	01	03	00	00	00	00	04
Viviparus sp.	00	01	00	00	00	00	01
Total NISP	04	09	25	03	04	06	51

As at other sites Hallur provided evidence for cattle, sheep, goats and hunted bovids. Although Hallur is located in a different ecological zone from the Bellary area sites, this is not reflected in the larger mammal fauna, perhaps because anthropogenic factors tend to produce similar savanna and woodland mosaic conditions. Not surprisingly Hallur yielded some evidence for the exploitation of resources from the adjacent river, indicated by the presence of a fresh water mussel (*Lamellidens* sp.) and fresh water snail (*Viviparus* sp.) (Table 7).

Layer 0 indicates remains collected from the surface of this site in this general area and could come from any period due to recent digging by the villagers. There were 45 unidentifiable fragments.

Archaeozoology of the Southern Neolithic: a Comparative Summary

The archaeozoological evidence reported above augments and confirms the previously available data from this and adjacent regions (see Venkatasubbaiah *et al.* 1992; Thomas and Joglekar 1994; Paddayya *et al.* 1995; Joglekar 1999a, 1999b, in press). The archaeozoological assemblage clearly indicates the importance of cattle in the economy, as had been inferred by previous workers (e.g. Allchin 1963; Paddayya 1992). In general terms, cattle dominated Southern Neolithic herds. This is clearly the case across all studied regions of the Southern Neolithic (Table 8). Herds appear to have included a small component of caprines. While the specific identification of goats is clear from nearly half the sites, confirmed presence of sheep is limited. Nevertheless both are present. Domestic chicken may also have been present during the Southern Neolithic as domesticated (larger) *Gallus* bones have been identified from a few sites, although further evidence is needed to clarify when during the Neolithic this species was introduced. Although water buffaloes are present in small quantities at a number of sites, it is not possible to osteologically determine their domestic status.

There are many wild mammal species in the present material (Table 9). This confirms evidence from larger assemblages for the hunting of game, especially antelopes and deer of savanna and savanna/woodland habitats, which we would expect to have been the most widespread vegetational types in the region of the Southern Neolithic. The antelopes, prefer open habitats and are the most ubiquitous amongst the wild fauna, which may reflect more open, grassland type settings in the immediate catchments of permanent habitational sites. The pig material from Tekkalakota was clearly of larger, wild type, and we suspect that previous reports of pig are also likely to represent wild game as they represent a rare component of the faunal assemblages. In general, despite regional differences in ecology the basic cattle-dominated pastoralism, supplemented by some caprine-herding and hunting, appears to have been shared across the Southern Neolithic province. Of particular significance is the evidence from a number of sites for at least occasional use of freshwater resources

Table 8: Presence data for domestic fauna across all Southern Neolithic sites for which data are available.

Site Name	Taxa: Abrev.	*Bos indicus*	*Capra hircus*	*Ovis aries*	*Capra/ Ovis*	*Gallus gallus*	Reference
Haveri region:							
Hallur	HLR	+	+	-	+	-	this study
Bellary region:							
Sangankallu	SGK	+	+	-	+	-	this study
Hiregudda	HGD	+	-	-	-	-	this study
Tekkalkota	TKT	+	+	-	+	-	this study
Kurugodu	KRG	+	+	-	+	-	this study
Hattibelagallu	HBG	+	-	-	-	-	this study
Velpumadugu	VPM	+	-	-	-	-	this study
Veerapuram	VRP	+	-	-	+	-	Thomas (1984)
Kudatini	KDT	+	-	-	+	-	Joglekar (1998-99)
Raichur region:							
Piklihal	PKL	+	-	+	+	-	Jogkelar (1998-99)
Utnur	UTR	+	-	-	+	-	Allchin (1963)
Mallur	MLR	+	-	-	-	-	Clason (1979)
Shorapur region:							
Kodekal	KDK	+	-	-	+	+	Clason (1979), Shah (1973)
Kannekolur	KLR	+	-	-	-	-	Clason (1979)
Budihal	BHL	+	+	+	+	+	Joglekar (unpublished)
Cuddappah region:							
Hanumantaraopeta	HRP	+	-	-	+	+	Venkatsubbaiah *et al.* 1992
Vaddirala	VDR	+	-	-	+	-	Venkatsubbaiah *et al.* 1992
Peddamudiyam	PMD	+	-	-	+	+	Venkatsubbaiah *et al.* 1992
Balijapalle	BJP	+	-	-	+	-	Venkatsubbaiah *et al.* 1992
Nagarajupalle	NRP	+	-	-	+	-	Venkatsubbaiah *et al.* 1992
Jangalpalle	JGP	+	-	-	+	-	Venkatsubbaiah *et al.* 1992
Inagaluru	ING	+	-	-	+	-	Venkatsubbaiah *et al.* 1992
Kolar region: Banahalli	BNH	+	+	+	+	+	Joglekar (unpublished)
Ubiquity (%)		100	26.1	4.34	78.26	21.7	

including mollusks and fish, even for hilltop sites of the Bellary region (Ashmound tradition) located some distance from rivers. All the available evidence for such exploitation may occur relatively late in the Southern Neolithic sequence, perhaps all during Phase III. Further systematic wet sieving and the small bone fraction recovered in flotation needs to be investigated for additional information on fish use in the Neolithic.

Summary columns at right show percentage of sites on which a taxon is present, and > grouped ubiquity = indicates the percentage of sites on which a larger taxonomic/ecological grouping is present (wild forest bovines, antelopes, cervids). The larger range of taxa at Budihal and Banahalli clearly reflects the larger sample sizes from those sites, and thus absence of taxa at other sites may not be significant. Sources of data and abbreviations as in Table 8. Note that several sites with

Table 9: Presence data for wild mammalian fauna from Southern Neolithic sites grouped by geographical region.

		Haveri	Bellary				Shorapur			Southwest Andhra					Kolar	ubiquity	grouped
Wild mammal taxa	habitat preferences	HLR	SGK	TKT	KRG	KDT	KDK	KKLR	BHL	HRP	VDR	PMD	BJP	NRP	BNH		ubiquity
Bos gaurus	forest/ woodland	-	-	-	-	-	-	-	-	-	-	-	-	-	+	7 1%	57.1%
Bubalus bubalis¶	woodland & swamps	-	-	-	-	+	+	-	+	+	-	+	+	+	+	57.1%	
Boselaphus tragocamelus	savanna	+	-	+	-	-	-	-	+	-	+	-	-	-	+	35.7%	71 4%
Antilope cervicapra	savanna	+	+	-*	+	-	-	-	+	-	-	+	+	+	+	64.3%	
Tetracerus quadricornis	savanna	-	-	-	-	-	-	-	+	-	-	-	-	-	+	14.3%	
Gazella bennetti	wooland to savanna	-	-	-	-	-	-	-	-	-	-	-	-	-	+	7.1%	
Cervus sp	wooland to savanna	-	+	-*	-	-	-	+	-	-	-	-	-	-	+	21.4%	50.0%
Axis axis	wooland to savanna	-	+	-	+	-	-	+	+	-	-	-	-	-	+	35 7%	
Axis porcinus		-	-	-	-	-	-	-	-	-	-	-	+	-	-	7.1%	
Muntiacus muntjak	wooland to savanna	-	-	-	-	-	-	-	-	+	-	-	-	-	-	7.1%	
Sus scrofa	ubiquitous	-*	-	+	-	-	+	-	-	-	-	-	-	-	+	21 4%	
Lepus sp.	ubiquitous	+	-	-	-	-	+	-	+	-	-	-	-	-	+	28.6%	
Elephus maximus	forest/ woodland	-	-	-	-	-	-	-	-	-	-	-	-	-	+	7.1%	
sample size (NISP)		52	25	49	43	22	?	?	>1000	49	51	77	43	35	1269		

*= Presence reported in previous work by Shirole in Nagaraja Rao and Malhotra (1965) or Alur (1971). These reports are excluded from the ubiquity calculation.

¶= Osteological evidence does not clearly indicate wild or domestic status for this species

domestic fauna (Table 8) are not included as wild taxa have not been found.

Bone measurements can be used to estimate the size of the animals. Particularly, the tarsals (astragalus and calacaneum) of domestic animals are important for estimating the height of cattle at withers. A limited number of such specimens are available and the estimates derived from them are given in Table 10. These cattle heights conform to the earlier observations made qualitatively that cattle from Southern Neolithic sites were of medium to medium-heavy build.

Table 10: Height at withers estimates for *Bos indicus* based on Southern Neolithic tarsal specimens.

Site and the State	**Cattle height in cm**
Nagarajupalle, Andhra Pradesh	104.3, 116.8
Kudatini, Karnataka	115.3
Banhalli, Karnataka	111.35, S.D. 5.97
Velpumadugu, Andhra Pradesh	122.06

Discussion

The evidence for identical livestock economy across different regions of the Southern Neolithic is comparable to evidence for plant cultivation. Most of the sites reported above yielded plant remains, which were generally abundant (with the exception of Velpumadugu, which was sampled to a very limited extent). Archaeobotanical evidence indicates that a consistent cropping regime was practiced across the Southern Neolithic province (Fuller *et al.* 2001; Fuller 1999). Emphasis was on monsoon (*kharif*) cultivation of the small millets *Brachiaria ramosa* (browntop millet) and *Setaria verticillata* (bristly foxtail millet-grass) along with the pulses *Vigna radiata* (mungbean) and *Macrotyloma uniflorum* (horsegram). A number of additional crops seem to have been selectively adopted during the course of the Southern Neolithic. *Triticum* (wheat) and *Hordeum* (barley), diffusing from the north and northwest; *Cajanus cajan* (pigeonpea) diffusing from the northeast (Bastar/ Orissa), and Pennisetum *glaucum* (pearl millet), *Lablab purpureus* (hyacinth bean) from Africa. *Eleusine coracana* (finger millet) was added only during Phase III at Hallur (HLR 98B). Wheat and barley indicate winter cropping at some sites. The gathered fruits and presence of unidentified tuber foods suggest plant food resources collected during the dry season. Thus plant evidence, together with the thickness of archaeological strata, is congruent with hilltop sites representing year-round habitation, a situation which contrasts with the major ashmound sites (Korisettar *et al.* 2001). We would therefore suggest that cattle herds, or at least a major component of them, were moved cyclically as part of a seasonal transhumance system of which the ashmounds were seasonal habitations or encampments with penning sites, where some caprines were also taken (see Allchin 1963; Paddayya 1998; Korisettar *et al.* 2001).

The origins of Southern Neolithic pastoralism deserve further investigation. The archaeobotanical data along with available biogeographical evidence for these species indicates that these crops are likely to have originated in south India, and the Southern Neolithic may thus represent an independent centre for the origins of cultivation (Fuller *et al.* 2001; Fuller 1999, 2001; Korisettar *et al.* 2001). Clear archaeozoological evidence for animal domestication within South India, however, is not available. Sheep and goat must have been introduced from the north/northwest, as these are early domesticates of Southwest Asia (Legge 1996; Horwitz *et al.* 2000), with sheep possibly also domesticated in Baluchistan (Meadow 1993). Chickens must have been introduced from the north, perhaps sometime in the first half of the second millennium B.C., as wild jungle fowl is replaced by congeneric *Gallus sonneratii* on the Indian peninsula (Crawford 1984). Evidence for the domestication of zebu cattle in Baluchistan is clear (Meadow 1993), and their separate origin from Southwest Asian (taurine) cattle is supported by genetic evidence (Loftus *et al.* 1994; MacHugh *et al.* 1997). Despite the hypothesis of separate cattle domestication in south India (Allchin and Allchin 1974, 1995; Naik 1978), bone evidence has not yet documented such a transition, nor does available genetic evidence yet clarify the situation. Evidence from Banahalli (Joglekar, in press) indicates that some large, wild type cattle populations persisted into this period. Future work needs to aim for chronological sequences that document the changing plant and animal assemblages from the Mesolithic through Neolithic phases in South India.

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A Rare Chalcolithic Pottery Cache from Balathal, Rajasthan

V.N. Misra and R.K. Mohanty[1]

G-2, B Wing, Ganga Park,
Mundhwa Road,
Pune 411 036

[1] Department of Archaeology,
Deccan College,
Pune 411 006

Abstract

This paper reports an unusual Chalcolithic pottery set from Balathal, The set consists of seven pots. Six of these comprise three beautifully painted Black-and-Red ware bowl, two medium-sized pots and one small pot in Grey ware. Inside of the medium-sized pots was found a large quantity of steatite disc beads and Job's tears which were intended stringing into necklaces. The pot, therefore, served as a lady's jewel box. All the six pots were carefully stacked inside a large Grey ware jar. The jar was placed close to a fireplace. The entire ambience of the find spot is that of a kitchen. The Chalcolithic deposit of Balathal is dated by 26 radiocarbon dates. The range of uncalibrated dates is 3000-1500 B.C. (calibrated 3700-2000 B.C.). One date obtained on charcoal collected from the fireplace itself has an uncalibrated reading of 2250 B.C. (calibrated 2880-2462 B.C.).

Introduction

The ancient site of Balathal (24° 43' N: 73° 59' E) in Udaipur district of Rajasthan has been excavated for seven seasons from 1994 to 2000 jointly by the Deccan College, Pune and Rajasthan Vidyapeeth, Udaipur (Misra 1997; Misra *et al.* 1995, 1997). The site covers an area of about two hectares and has a habitation deposit of about 7.5 metres. The upper layers of the deposit, of variable thickness have been destroyed over two thirds of the site by conversion into cultivable land by local farmers. The remaining third of the site, the central part, is intact and remarkably flat which is where our excavation has been concentrated. Some additional excavation has also been carried out in the partially destroyed southern and northern parts of the mound to find out the extent and thickness of the habitation and nature of the cultural material.

Two cultural periods have been identified at the site: I. Chalcolithic, and II. Early Historic.

The Chalcolithic period has a maximum deposit of 5.5 m and is divisible into two phases, A and B with the lower 1.5 m belonging to. Phase A. Phase A is marked by stone, mud-brick and mud structures, copper and stone technology, and ceramics like Thick Red-Slipped Ware, Burnished and Unburnished Grey wares, and Black-and-Red ware. The Red and Grey wares are decorated with incised designs with a limited repertoire while the Black-and-Red ware is profusely decorated with painted geometric designs in white pigment. Phase B marks considerable improvement in architecture and material culture.

A significant feature of Phase B is a massive fortified enclosure in the centre of the settlement. The enclosure, sloping gently from north to south, is sub-rectangular, with its longer wall (37 m), running east-west and shorter walls (28 m), running north-south. The height of the walls ranges from 3.5 to 4 m, and their width is about 7 m at the base and 5 m at the top. The core of the walls is made of earth with a sprinkling of stones. The earth contains Chalcolithic potsherds and animal bones and was, therefore, dug out from Phase A habitation deposit. However, the sides of the walls, up to a width of 1.25 m, are made of semi-dressed stone slabs. The fortification is provided with rectangular or square bastions on all four corners. It encloses an open space of about 600 m^2, which is filled from the bottom to the top, with burnt cow dung and ash. The burnt cow dung and ash belongs to the Chalcolithic period as is shown by the presence of secondarily burnt Chalcolithic potsherds within the ash, Chalcolithic habitation deposit abutting the outer surface of the fortification walls right up to the top, and sealing of the cow dung and ash by the sterile layer, 4, which is followed by Early Historic deposits The other features of Phase B are incipient planning of the settlement, impressive domestic architecture, comprising multi-roomed houses, and new ceramics like Tan and Thin Red wares. Both these wares are made of fine and well-levigated clay, baked at a high temperature, and are sturdy. The Tan ware bears close similarity in fabric and shapes to the Harappan pottery of Gujarat and Rajasthan. Besides, there is an improvement in the quality of Black-and-Red ware, and the range of incised decorative motifs in Thick

Red-Slipped and Grey wares increases considerably. The new elements in Phase B seem to have been introduced as a result of contact between the Balathal people and the Harappan people of these neighbouring regions.

Of the 31 radiocarbon dates available for the Chalcolithic period, 26 range from ca. 3000 B.C. to 1800 B.C. (uncalibrated) or 3700 B.C. to 2000 B.C. (calibrated). Five dates, however, fall outside this bracket. These are 4540 B.C. 4330 B.C., 3820 B.C., 650 B.C. and 390 A.D. Of these, 3820 B.C. may not be far removed from reality because it comes from the bottom most layer, No. 23, of Trench OE. The dates 4540 B.C. and 4330 B.C., however, appear to be too early, and 650 B.C. and 390 A.D. are obviously too late.

A sterile layer, No. 5, of about one metre thickness, separates the Chalcolithic and Early Historic deposits and denotes a gap of about 1500 years between the two occupations. The Early Historic period is represented by layers 1-4, and has a maximum deposit of 1.50 m. The main occupation was in layer 3. This layer shows considerable burning activity, suggesting that the settlement was destroyed by a conflagration. Of the fourteen radiocarbon dates available for this period, seven range from 400 B.C. to 130 A.D. Four dates, however, are far outside this bracket. These are: 5230 B.C., 1580 B.C., 1560 B.C. and 1160 B.C. Of these, 1560 B.C. may not be far off the reality because it comes from layer 4 in Trench B4, the sterile layer underlying the Early Historic deposit, and the charcoal sample, from which it is derived, may have come from an older Chalcolithic layer due to likely disturbance caused by the Early Historic settlers at the deserted site.

During the 1999-2000 season, excavation was done in the area inside the fortified enclosure, on the eastern edge of the mound, and in the cultivated field (then lying fallow due to a prolonged drought), belonging to Mr. Nathu Krishna, beyond the northern edge of the mound. Four trenches, namely Q13, Q14, R13 and R14, each measuring 5 x 5 m, were partially dug in the cultivated field. Here the upper part of the Chalcolithic deposit had been destroyed by agricultural activities. However, the fact that fully intact structures of stone, mud-brick and mud occurred just below the surface of the field, clearly shows that the destruction caused by agricultural activities did not proceed very deep. In Trench Q13 digging was done only in the NE quadrant, in Trench Q14 in the NW and SW quadrants, in Trench R13 in the SE quadrant, and in Trench R14 in the SW quadrant, the total excavated area being only 31.25 sq. m. However, even in this limited area as many as four structures (Nos. 45, 45A, 45B and 46) were found. The nature of their construction was similar to that of the structures of Phase B seen in other parts of the site, except that the walls were narrower. However, the rooms were quite spacious, at least 4.50 m x 3.50 m in size. The area also proved to be unusually rich in material culture, yielding several antiquities of copper and terracotta, in addition to intact clay pots.

The stratigraphy of the SE quadrant of Trench R13, in which the pottery cache, subject of this article, was found, is as follows. The depths given are below datum.

Layers 1-5 0.0-4.64 m	Not present as the Early Historic occupation is absent to the north of the fortified enclosure
Layer 6 4.65-5.25 m	Partly destroyed by ploughing; loose whitish sandy earth
Layer 7 5.26-5.57 m	Compact whitish clay floor
Layer 8 5.58-5.72 m	Burnt reddish and greyish earth with ash and potsherds
Layer 9 5.73-5.95 m	Compact greyish mud floor

An interesting discovery was made in layers 8 and 9 of the SE quadrant of Trench R13. A compact circular platform made of clay and having a diameter of 80 cm and a height of 10 cm was noticed. Over and around this platform, plenty of ash, charcoal, clods of burnt earth, a number of charred animal bones and grains, and a few potsherds were found. Some charred grains were also sticking to the hollow surface of a broken charred bone. Dr. M.D. Kajale (personal communication) who is studying the botanical material from Balathal, has identified the charred grains, as belonging to barley (*Hordeum vulgare* L.) and safflower (*Carthamus tinctorius* L.). The entire mud platform and the area around it is heavily burnt, clearly showing that the platform served as a fireplace in which meat and grains were roasted. In addition, a miniature convex-sided

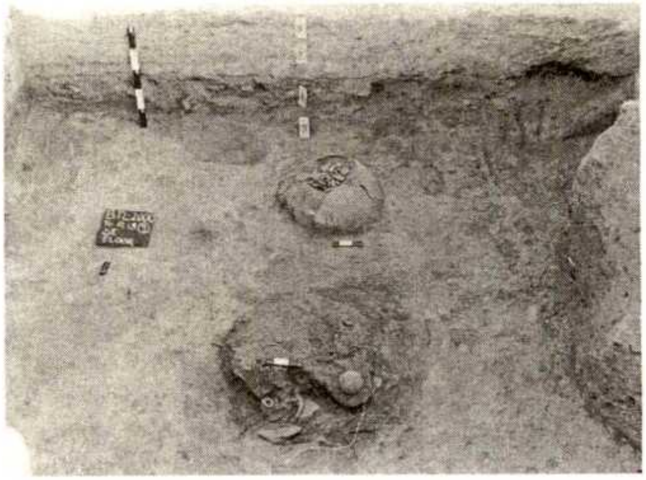


Fig. 1: Photograph of the circular fire place containing ash, charcoal, charred animal bones and grains, potsherds, a spherical stone ball, and a large grey ware jar to its north in the SE quadrant of Trench R13.

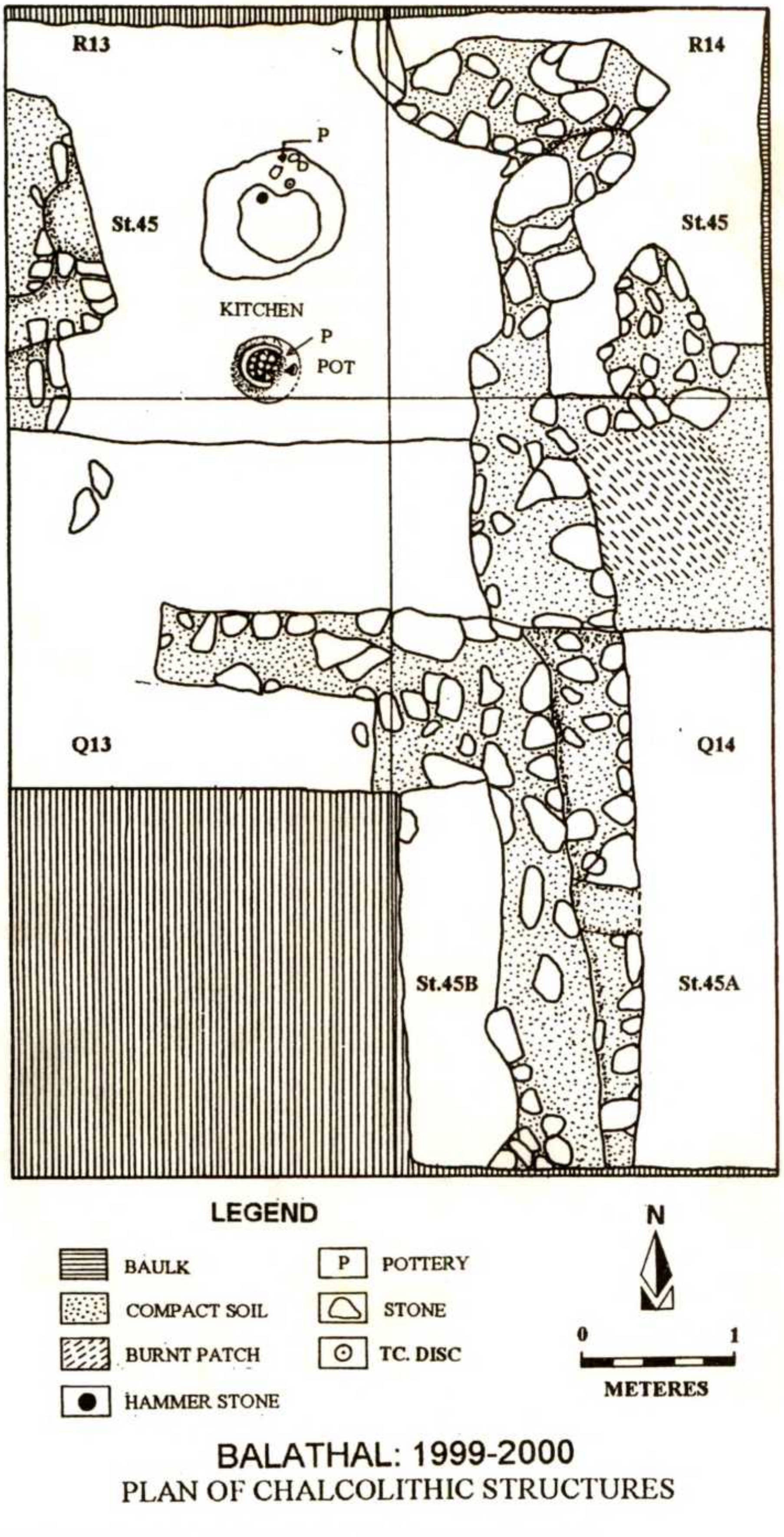


Fig. 2: Drawing of the structure containing the fireplace in Trench R13

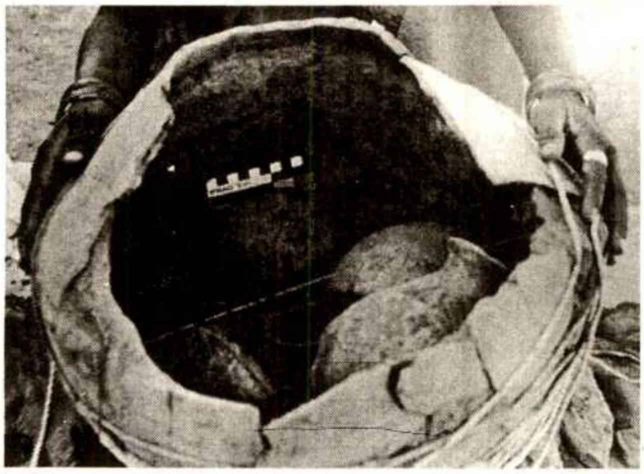


Fig. 3: Large jar, after removing the earth, showing six carefully arranged small pots inside it

complete pot, broken *in situ*, an intact copper bangle, a piece of a copper knife, a clay bull figurine, five terracotta perforated discs or cart wheels, and a dish-on-stand in Grey ware were also found in the same stratigraphic horizon as the fireplace. A perfectly spherical stone was placed on top of the mud-platform forming a part of the fireplace. About 30 cm to the south of the mud-platform, a large globular pot was buried in the floor in a vertical position. Its rim is partly broken and body had developed many cracks, due to the weight of the overlying habitation debris (Figs. 1-2).

The surface of the NE quadrant of Trench Q13 to the north of the E-W running wall of structure No. 45A is about 16 cm higher than the platform in the SE quadrant of Trench R13. This surface is also burnt red. To the west of the platform there was a broken globular pot with a constricted neck (*handi*), and terracotta perforated disc. Four more terracotta discs were found in the same area a little above the disc mentioned above. The fireplace seems to have been made in a shallow pit as shown by its outline and the nature of the earth, which is much darker than the surrounding deposit due to severe burning activity.

The fireplace and associated objects, including the vessels described below, clearly show that they are part of a kitchen. The kitchen was located inside a small room (Structure 45A) the walls of which are made of mud and stone pieces. The western wall of this room is intact and has been fully exposed while the eastern, northern and southern walls are only partially preserved (Fig. 2).

One radiocarbon date BS-1749, 2250 B.C. (uncalibrated), was obtained from charcoal collected from the fire place in layer 8 directly dating the kitchen and the pottery cache. Calibration of the date gives a range between 2462 B.C. and 2880 B.C. showing that the dated items belong to Phase B of the Chalcolithic period at Balathal.

The large pot was carefully lifted and brought to the camp. As its body was heavily cracked, a string was wrapped around it to prevent the cracked parts from falling

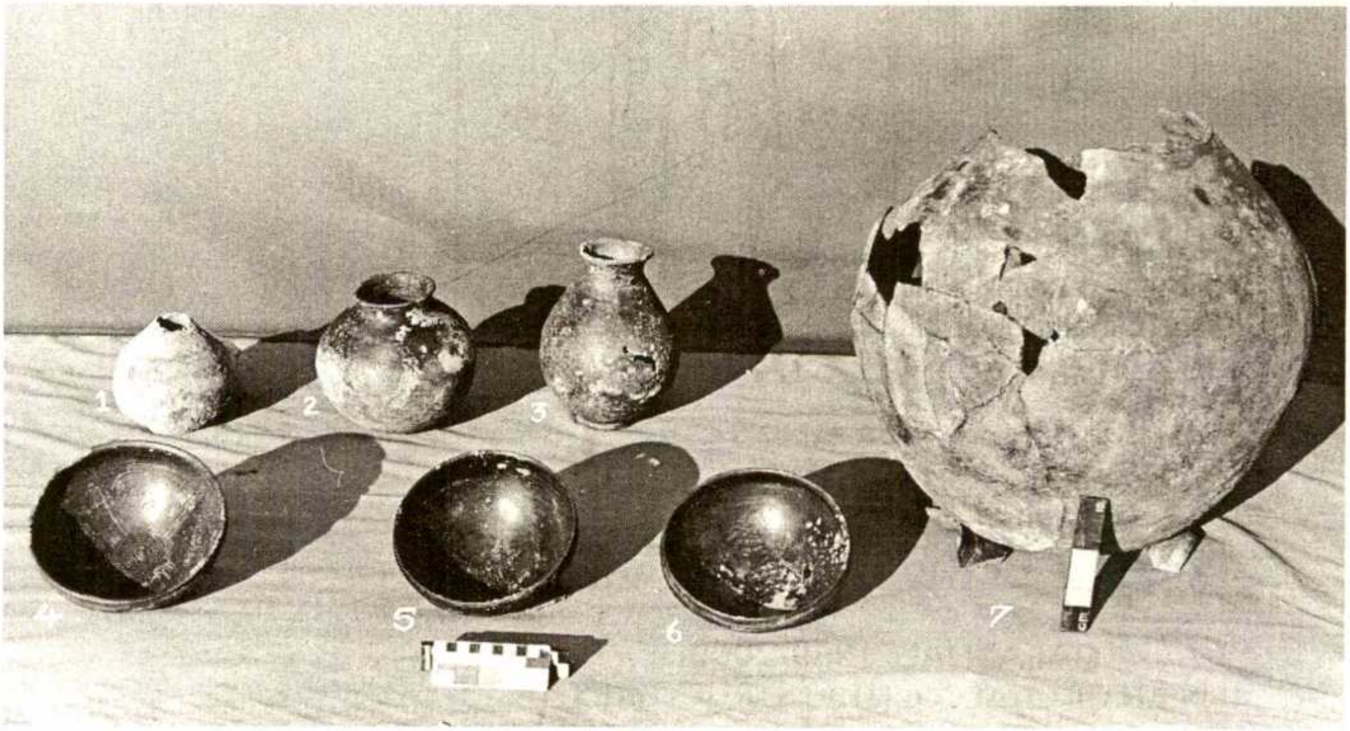


Fig. 4: Large jar and six small pots found inside it

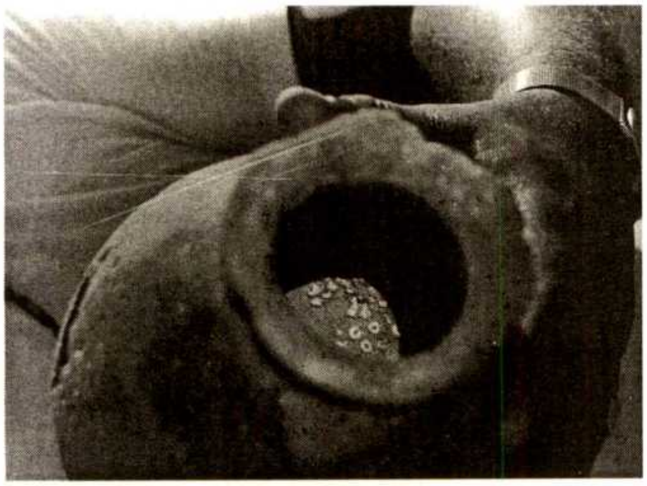


Fig. 5: Steatite disc beads and coix fruits inside the narrow-mouthed, S-shaped vessel

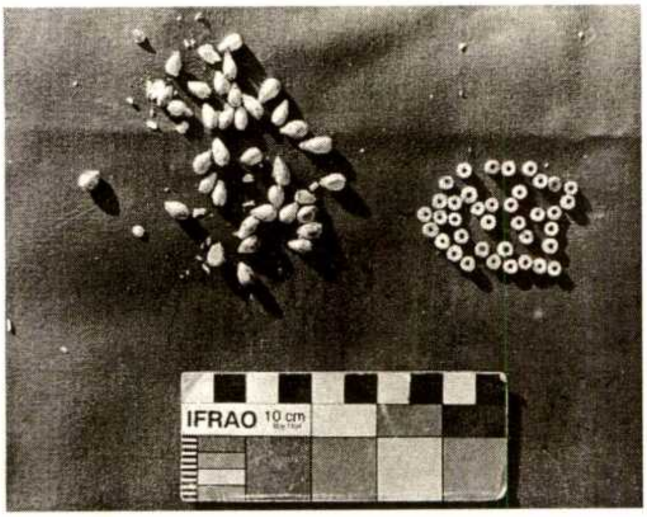


Fig. 6: Close-up of steatite disc beads and coix fruits

apart. However, as removal of the earth from inside it proceeded, several cracked pieces got detached (Fig. 3) but these were later joined together with adhesive (Figs. 4, 8).

As the earth from the large pot was being removed, a surprise was in store for us. One after the other six smaller pots became visible. They were meticulously packed, individual pieces being placed either sideways or upside down, to minimize the gap between them with a view to preventing damage to them (Fig. 3). The pots were carefully taken out and cleaned to remove the earth filling or sticking to them.

The pots are individually described below:

Pot no. 1: is a large globular jar in Grey ware. It has a height of 48 cm and a diameter of 45 cm, at the widest part of the body. The diameter of the mouth at the rim, which is featureless and externally projecting, is 22 cm while that of the neck is 18 cm. The top 10-cm part of its outer surface is slipped and burnished while the lower portion is rusticated by the application of sand. The bottom of the pot is rounded and, therefore, the pot would have needed a support or was placed on a concave surface for staying upright. A part of the outer surface is dark grey in patches, showing uneven firing (Figs. 3, 4, 7).

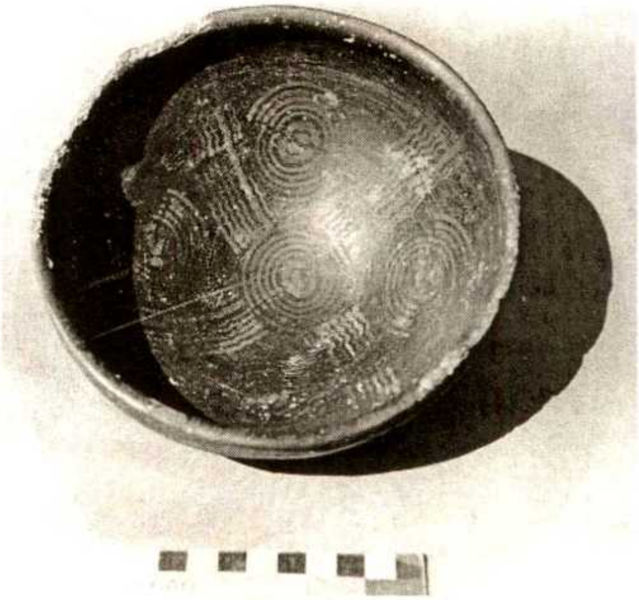


Fig. 7: Photograph of one of the Black-and-Red ware bowls painted on the inside in white with five multiple circles panelled by groups of wavy lines

Pot no. 2: is a medium-sized globular vessel in Grey ware. It has a height of 17 cm and a diameter of 17.5 cm at the point of maximum body width. Its diameter at the mouth is 8.5 cm and at the neck 6.7 cm. The entire external surface is uniformly slipped and burnished, creating a smooth effect, although in some parts the slip has worn off, probably due to use. The inner surface is unslipped except for the visible portion of the mouth. The vessel is made of relatively coarse clay containing tiny stone particles and plenty of mica. The baking has been done at a low temperature. Because of the poor quality of clay and imperfect firing, the vessel has developed a crack on one side, and the edge of the rim has chipped off in places. The colour of the body is pale red except in the upper part and the mouth, which are black. This creates a deceptive impression that the vessel belongs to Black-and-Red ware but it is not so because this shape does not occur in this ware, which is otherwise very common at the site (Fig. 4, No. 2).

Pot no. 3: is an elegant looking, medium-sized, S-shaped vessel in Grey ware. It has a height of 20 cm and maximum body diameter of 16 cm. The diameter of the mouth

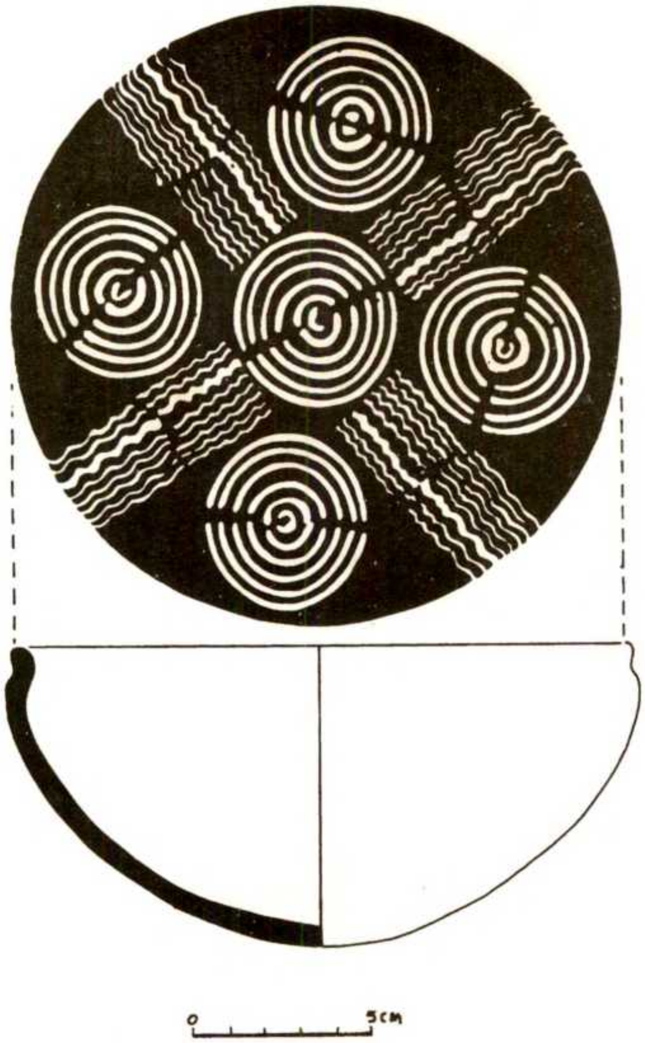


Fig. 8: Drawing of the bowl shown in Fig. 7, showing detail of the paintings

at the rim is 8 cm and that of the neck is 5.5 cm. The vessel is made of coarse clay containing tiny stone particles. The rim and the entire external surface is slipped and finely burnished, producing a smooth effect. The colour of the outer surface is pale grey but in patches it is ashy grey, and that of the inner surface is dark grey. The vessel has a round disc base with a diameter of 6 cm and a height of 5 cm. A large crack has developed on one side and there are three small breakages, due to the poor quality of clay and inadequate firing.

When the earth inside the pot was removed, forty-two steatite disc beads and a profuse quantity of Job's tears (*Coix lachryma jobi* L.) were found mixed in it, and many are still embedded in the earth sticking to the inner bottom of the pot (Figs. 4-6). The Job's tears are very fragile and break easily and get crushed into powder when separated from the earth containing them.

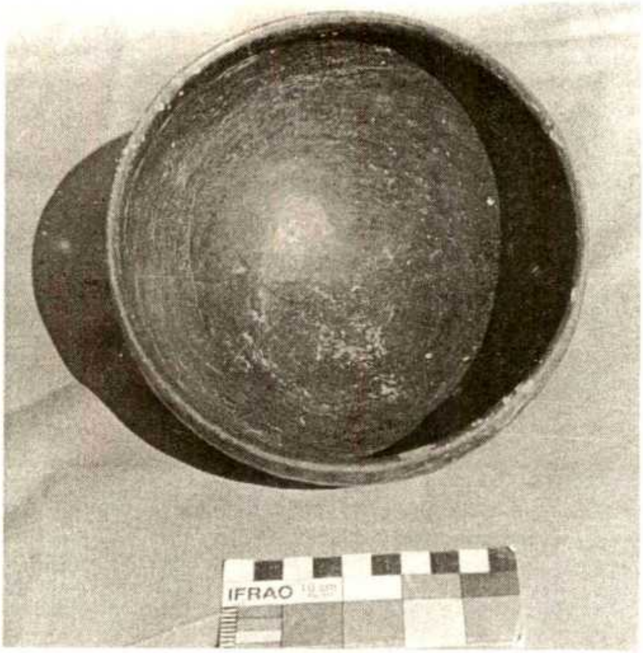


Fig. 9: Photograph of the second Black-and-Red ware bowl painted on the inside in white

Pot no. 4: is a bowl in Black-and–Red ware. It has a knife-edge rim and a mild carination just below the rim. The bowl has a height of 8.5 cm and the diameter of its mouth at the rim is 17.3 cm and below the rim 15.8 cm. It is made of coarse clay containing tiny sand particles. Both inner and outer surfaces were treated with a slip and burnished, producing a shining effect, especially on the inner face. Due to the effect of inverted firing the inner surface of the bowl has turned uniformly light black in colour whereas

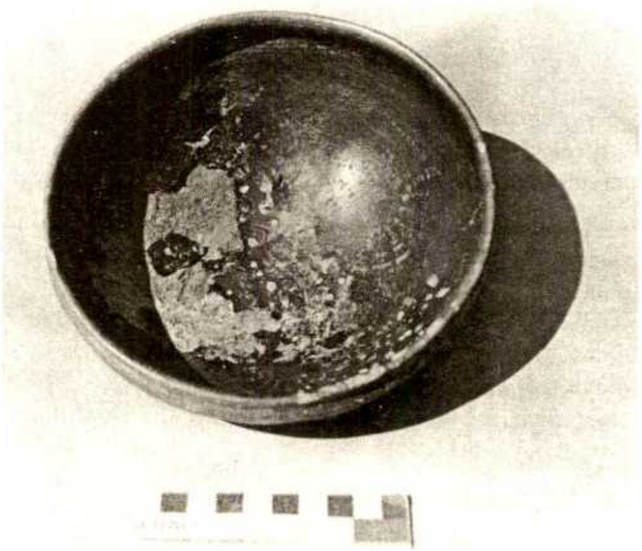
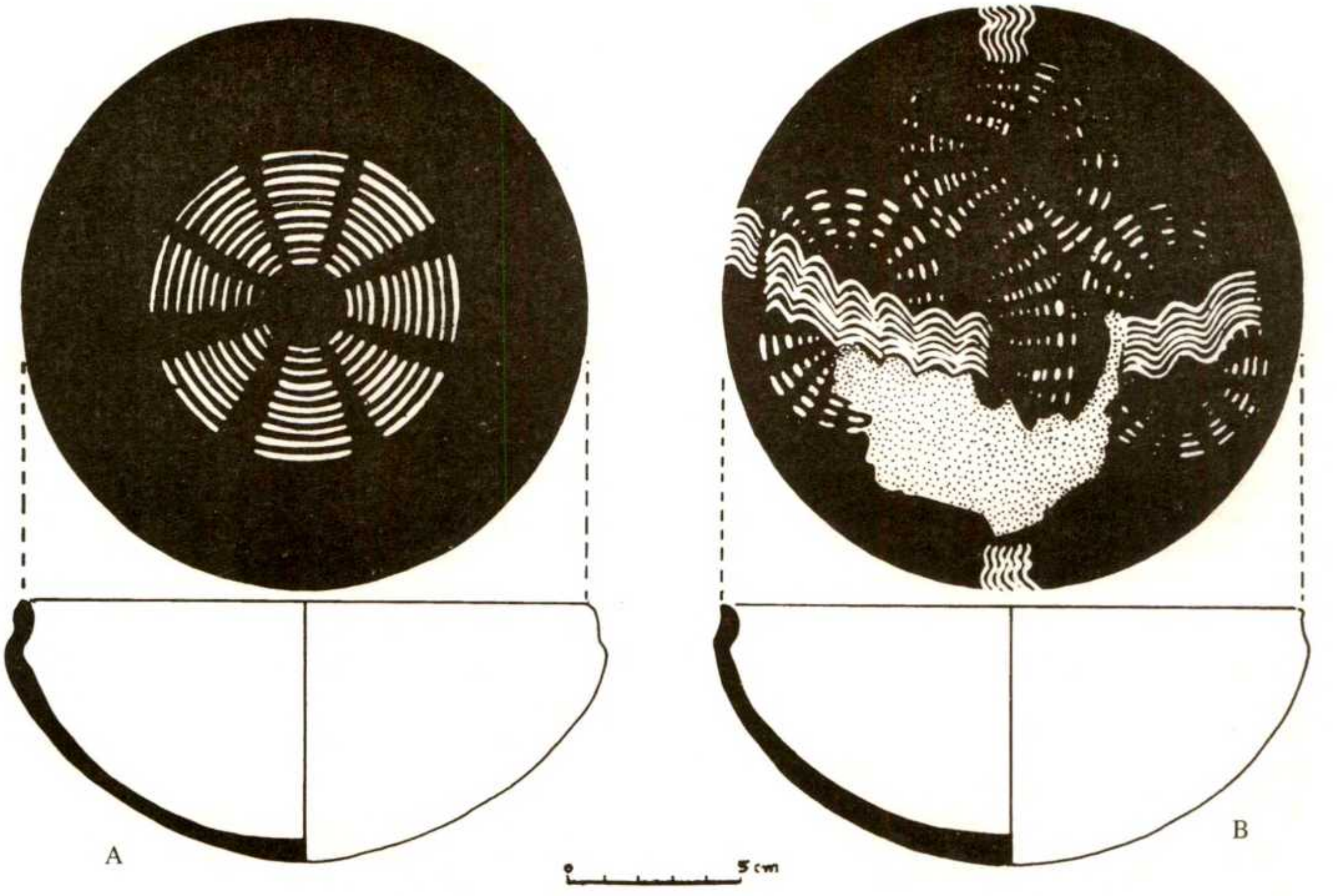


Fig. 10: Photograph of the third Black-and-Red ware bowl painted on the inside in white



Figs. 11a and b: Drawing of the bowls shown in Figs. 9 and 10, showing details of the paintings

the outer surface is black only for a width of one cm near the rim and the rest of it is pale red to bright red. The intensity of the colour increases from the top toward the bottom.

The entire inner surface of the bowl is decorated with painted designs in white pigment, which has turned pale after firing. The designs consist of five sets of six concentric circles each, the size of the circles increasing from the centre to the periphery. One set of the circles is in the centre of the bowl and the other four are on the sides. The circles are partitioned into two by a two millimetre blank space in the middle. The side circles are placed in panels or compartments, which are formed by eight or nine wavy lines originating from the rim of the bowl and touching the central circle, and are placed on both sides of individual sets of circles (Figs. 7, 10).

Pot no. 5: is a bowl similar in shape, size, and technique of manufacture, surface treatment and decoration to pot No. 4. However, the painted design is different. It consists of ten concentric circles in the centre of the bowl. The circles have eight narrow blank spaces at equal intervals which produce the effect of spokes of a wheel (Figs. 8, 11A).

Pot no. 6: is also a bowl of the same shape, size, technique of manufacture, surface treatment and decoration as pot noes. 4 and 5, and differs from them only in the nature of paintings. Instead of the five sets of circles in pot no. 4, this one has only three sets on the sides, and none in the centre. If a fourth set existed on the side, it has got totally defaced. These sets are made of short multiple dashes of varying sizes instead of the continuous lines in pot no. 4 and comparatively long lines in pot no. 5. Further, the sets do not have one blank space, as in pot no. 4, or eight blank spaces, as in the single set in pot No. 5, but at least eighteen blank spaces at short intervals. The place of the central circle is taken by a row of multiple small dashes arranged in a semi-crescentic shape. Also, although this bowl too has four sets of multiple wavy lines, they are not used to separate the sets of circles but in stead run over or beneath the circles. A small part of the decoration has been obliterated because of the peeling away of the slip (Figs. 9, 11B). b

The painted designs on the three bowls are closely similar in form and technique of execution to those on Black-and-Red ware bowls from other Chalcolithic sites like Ahar, Gilund and Navdatoli.

Pot no. 7: is a small globular vessel in Grey ware with a very narrow mouth, measuring only 3 cm, and a narrow and unstable base, It has a height of 10 cm and its maximum diameter is 13.6 cm. It is made of very coarse clay and is very poorly baked, with the result that its body is crumbling and its mouth and one side is slightly broken. On its outer surface a thin slip was applied but not all over the body, and most of it has peeled off. Its core is ashy grey in colour, its surface is peeling off in pieces of two to five mm thickness (Fig. 4, No. 1).

Complete pots, especially in groups, are mainly found in graves, and only rarely in habitation areas so the discovery of six intentionally stored intact vessels in a large pot at Balathal is an unusual, if not unique, event. The context of the discovery close to a fireplace containing charred animal bones and grains clearly establishes that the large pot containing six smaller pots formed part of a kitchen. The three Black-and-Red Ware bowls and the two medium-sized vessels are very carefully and elegantly made. Besides, the Black-and-Red ware bowls are profusely and attractively decorated with geometric designs in white pigment. The designs in pot Nos. 4 and 5 are so perfectly executed that they look almost carbon copies of each other.

The six vessels clearly constitute a dining set, which was of special importance, and, therefore, carefully stored inside the large globular jar. It would appear that the set was taken out for use only on special occasions much as today one takes out expensive crockery and cutlery from the shelf on special occasions. It is also significant that one of the vessels was also used for storing steatite disc beads and Job's tears, both of which were used as components of necklaces. Job's tears have been found in large quantities at the Harappan site of Kuntasi in Suarashtra (Kajale 1996) and at the Megalithic site of Bhagimohari in Vidarbha (M.D. Kajale, personal communication). Even today they are used by the members of the Juang (Kanungo 2001: 9) and Bondo (Kanungo, in press) tribes in Orissa, as well as by the Muria Gonds and other tribal communities in Madhya Pradesh for making necklaces (Personal communication from Dr. Malti Nagar). The large pot containing six smaller pots, one of them used for storing ornaments, would appear to be an equivalent of the modern-day wooden or metal chest used for storing family valuables.

We are not aware of a comparable discovery from any other archaeological site in India.

Acknowledgement

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Ochre Coloured Pottery: Its Genetic Relationship with Harappan Ware*

M.D.N. Sahi

223, Adarshnagar, Marris Road,
Aligarh 202 001

Abstract

Ochre Coloured Ware Pottery (OCP), based on research of the last 50 years, occupies a very significant place as one of the earliest protohistoric entities in India. Two distinct and separate chronological horizons have been assigned to the OCP. It has been considered Pre-Harappan on the basis of evidence from the excavations at Ganeshwar and Jodhpura in Rajasthan while in the Ganga-Yamuna *Doab* it is designated as a 'Late Harappan' Pottery. Our attempt here is to examine whether there is a genetic relationship between Ochre Coloured Pottery and the Harappan Ware. Both are sturdy and heavy red ware with monochrome, black painting on a red slipped surface. The area of distribution of the two wares also partly coincides. Cultural relationships are reflected in pottery styles and therefore, emphasis on pottery forms is given.

Introduction

Lal (1951: 37) coined the term 'Ochre-Washed Ware' to denote a ceramic complex, associated with the copper-hoards, while reporting on his trial excavations at Bisauli and Rajpur Parsu. Subsequently in 1952, similar 'Ochre-Coloured Ware' was found in the lowest levels of Hastinapur (Lal 1954-55: 11) and at Bahadarabad (Sharma 1964: 11-13). Since that time, several sites, such as Bargaon, Ambkheri, Alamgirpur, Hulas, Atranjikhera (Gaur 1983), Lal Qila, Saipai, Ahichchhatra, Pariar, Baharia and Sringaverpur, have revealed in excavations, different facets of this culture in the Ganga-Yamuna *Doab*. In the mid Ganga valley some resemblance has not only been noticed between the pottery of Atranjikhera and Lal Qila and those found at Koldihwa II and Kausambi I (Misra 1969: 205) but the extension of this pottery in this area has also been indicated (K. Kumar 1991: 155). This pottery was also found in the lowest levels at Prahladpur (T.N. Roy: Personal Communication) further east. To the west of the Yamuna, pottery resembling that of Atranjikhera and Lal Qila was found in excavations at Noh and Jodhpura in Rajasthan (Kumar 1977). An unbroken series of OCP sites has been found during exploration along the Sahibi and its tributaries in the area, (Margabandhu and Sharma 1978-79) connecting Jodhpura and the Ganga–Yamuna *Doab*. Recently, about two hundred sites have been reported from only three districts namely, Jaipur, Sikar and Jhunjhunu of Rajasthan (Hooja and Kumar 1995). In Haryana several sites have been reported in the districts of Jind, Karnal and Ambala (Bhan and Shaffer 1978: 62). The northern most is Sarangpur to the north of Chandigarh (Bhan 1967). A number of OCP sites have also been reported from eastern Punjab, Katpalon on the right bank of Sutlej being one of them (Dikshit 1979a,b).

Thus, it is evident that OCP has a very wide dispersal area, within the triangle formed by Katpalon on the Sutlej, Allahabad on the confluence of the Ganga and Yamuna and Jodhpura (Jaipur) (Fig. 1).

Several scholars have classified OCP into groups on the basis of local variations. Sharma (1971-72: 21) has divided OCP into five categories (i) Harappan and thoses similar to that found at the sites of (ii) Bahadarabad, (iii) Atranjikhera, (iv) Lal Qila and (v) Saipai. Bhan (1971-72: 17) has classified OCP into two broad groups A and B. His group A comprises OCP associated with Harappan and Cemetery-H potteries, as at Ambkheri and group B where it is not associated with Harappan and Cemetery-H pottery as at Atranjikhera and Saipai.

A high population density during OCP times is indicated by the occurrence of around 80 sites in Saharanpur district, 50 in Muzaffarnagar district and over 156 sites in Aligarh district (Haider and Kumar 2001). In

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* The paper is dedicated to Prof. B.B. Lal who introduced the term *"Ochre Coloured Pottery"* in Indian Archaeology, and who is a pioneer in the field of Harappan Studies.

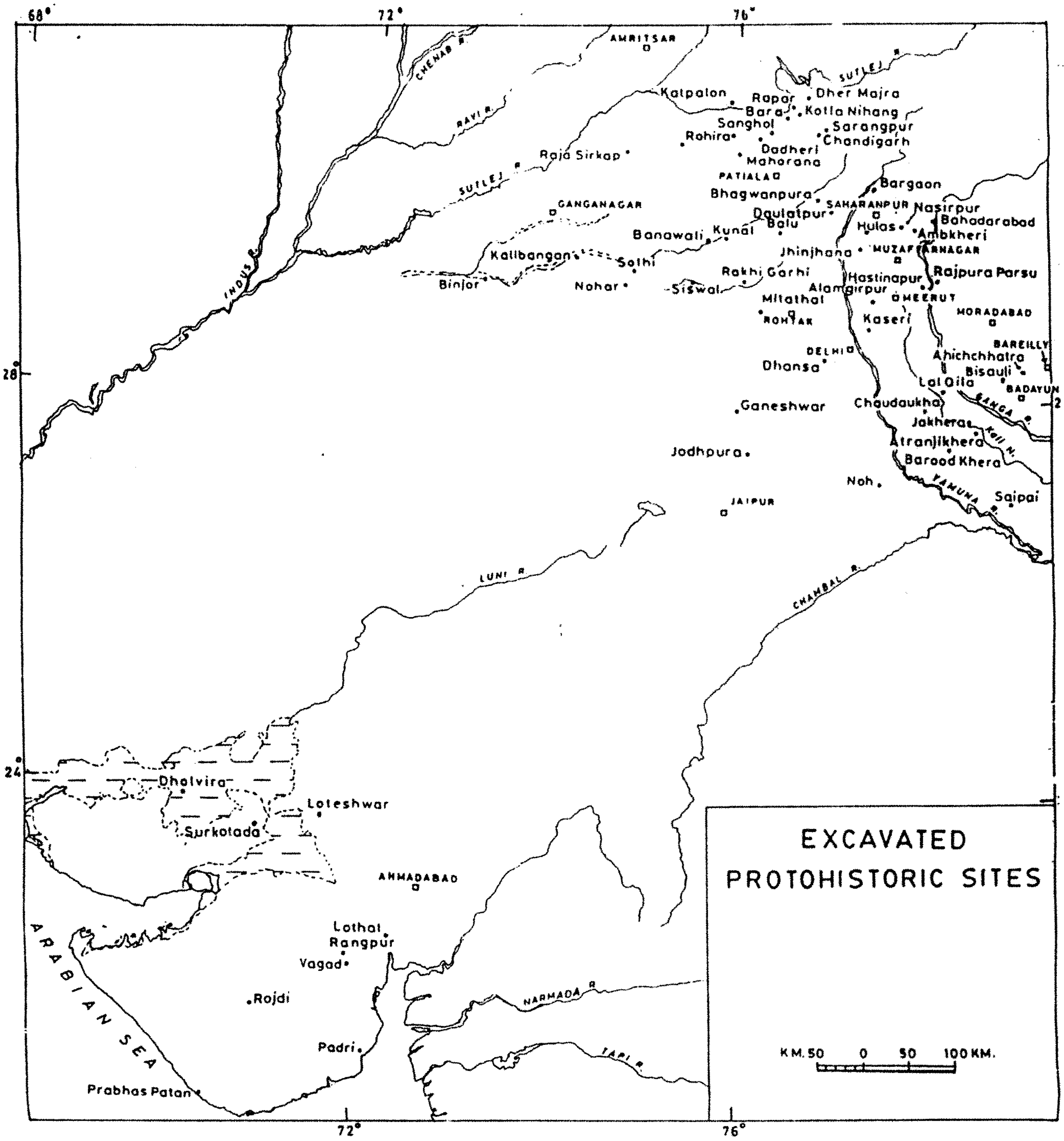

Fig. 1: Map showing excavated protohistoric sites

addition, 200 sites are reported in three districts of Rajasthan namely Jaipur, Sikar and Jhunjhunu (Hooja and Kumar 1995).

In spite of the fact, that early levels of OCP of the Ganeshwar- Jodhpura Complex has been dated as early as 3000 B.C. (Agrawal 1984: 160), many scholars, such as Ghosh (1964), Handa (1968), Krishna Deva (1969), Deshpande (1969), Gupta (1971-72), Dikshit (1979a, b; 1982) and Lal (1979,1997) believe that OCP of the Ganga-Yamuna *Doab* is 'Late Harappan' in chronology. This is also the case with Bara ware.

It is generally believed that Harappans of the lower Ghaggar and Saraswati valleys moved towards the Ganga-Yamuna *Doab* after their settlements declined as a consequence of the drying up of the lower courses of these rivers. Thereafter, settlements like Alamgirpur came into being (Lal 1979: 93). Since OCP is found associated with the Harappan pottery at Alamgirpur it is also considered as 'Late Harappan'. It has been held that 'since there is neither a city nor town dating back to the Harappan period in the region, it may be inferred that one is dealing with a deurbanised phase of the Harappan culture. This is what has been called the 'Late Harappan' (Dikshit 1982: 346). According to another view, Alamgirpur and Hulas are Late Harappan because of the occurrence of evolved types, like the vase with flanged rim, bowls with blunted rim or flaring rim recalling the Mitathal II B types and the occurrence of an identical harpoon at Mitathal and Saipai (Bhan 1971-72: 20). It is also considered late because the above mentioned shapes which are typical of Bara ware have been found associated with PGW at Bhagwanpura, Dadheri, Katpalon, Nagar and Sanghol.

Late Harappan Scenario

A recently reconstructed, emergent picture of the Late Harappan period has been given as:

> "Due to the hydraulic changes adversely affecting the availability of water in the middle and lower courses of the perennial river systems like the Ghaggar-Saraswati, made the Harappans leave their settlements and break their urban fabric for ever. In the wake of these two phenomenon, lies the fragmentation of Harappan cities, both qualitatively and demographically. No wonder, the late Harappan sites registers manifold increase, but in a non-urban scenario of smaller and shallower settlements, much closer to each other than earlier, shows an intimate cultural affinity which they did not shed off. The movement of the late Harappans, favoured area in the northern regions of present state of Punjab, Haryana and Uttar Pradesh, since in these areas the older systems still retained water besides, nearness to timber and minerals, which became essential need in a less economically viable late Harappan society in the region. The directional change in the settlement pattern from Harappan to late Harappan phase has been from west to east and from major river valleys to tributaries in the higher regions. This was the situation in Uttar Pradesh where during the late Harappan times, the tributaries of the Yamuna (Krishni and Hindon) are favoured" (Joshi 2000: 25).

Accepting such a model for the Late Harappan period however, raises some problems:

1. It would imply that between 3000-1900 B.C. when pre-Harappans and Harappans were flourishing just on the western side of the Yamuna in Haryana and Eastern Punjab, the Ganga-Yamuna *Doab*, a contiguous land-mass, was without any habitation, although the Yamuna is presumed to be tributary of the Saraswati during that period.
2. It implies that the radiocarbon and TL dates for sites like Hulas (3000 B.C. and 2460 B.C.), Jhinjhana (2650 B.C.), Atranjikhera (2280 B.C.) and Lal Qila (2030 B.C.) are meaningless and unreliable dates.
3. It also implies that a society, with such a density of population, cultivating a rich variety of agricultural crops, as revealed from the excavation at Rohira, Hulas and Lal Qila, and having an enormously rich copper technology in quality as well as quantity, remained static for about 800 years i.e. from 1900-1100 B.C. or till their settlements were destroyed due to the 'deluge' suggested by Lal (1971-72: 101-104).
4. If we set aside the number of pre-Harappan and Harappan sites from the listed protohistoric sites of Punjab, Haryana and Rajasthan (Joshi *et al.* 1984) leaving the rest as Late Harappan sites; then, where are the contemporary rural Harappan sites? Their number should have been fairly large in view the known urban centres. To date there are 616 Mature Harappan sites in India and 406 in Pakistan, whereas there are 1281 late or Post Urban Harappan sites in both the countries (Possehl 1999: 4). Misra(1993: 513) on the other hand has mentioned that there were 138 Pre-Harappan, 250 Harappan and 696 Late Harappan sites in India. Were the Mature Harappan rural settlements also deserted? What was the rural-Urban settlement ratio?
5. Gupta (1982: 53) rightly points out that the limited number of Mature Harappan sites could not have disintegrated into so many settlements (of Late Harappans) even conceding the possibility of a higher population growth rate for this period. If this is accepted, then where did people arrive from to produce so many late Harappan settlements.
6. It also implies that the large numbers of heavy implements, including those of offence and defence recovered in Copper Hoards, were the handiwork of decadent, degenerate and de-urbanised refugees.

In the light of the problems raised above we would prefer to question the 'Late Harappan' concept. Gupta (1997: 139) has expressed a more or less similar view recently. He admits that the Early, Mature and Late phases of the Indus-Saraswati civilization, presents a very distorted picture of the ground realities. Not that these are untrue but certainly not completely true. Thus, to put OCP as only 'Late Harappan' ceramic complex may not be completely true.

Now, in order to understand the roots, stages of development and ramifications of OCP culture, it is desirable to examine the evidence in its totality available at Ganeshwar-Jodhpura complex. It is only then, it may be possible to fix the chronological horizon of the OCP sites in the Ganga-Yamuna *Doab*.

Ganeshwar–Jodhpura Complex

This complex is defined by material from the two mentioned excavated sites. Jodhpura (27° 31' N; 76° 5' E) in District Jaipur is a large site (5-10 Ha.) located 98 km from Jaipur town. The site is situated on the right bank of the Sabi (Sahibi) river near its source. It is hardly 15 km away from Bairat (Dist. Jaipur) – the old capital of Matsya desh. Ganeshwar (37 °40' N; 75° 51' 30" E) is in Sikar district of Rajasthan. It is linked to the Harappan sites of the Drishadwati-Saraswati and Ghaggar via the Kantali, which has its source near Ganeshwar. It is believed that this river once joined the Drishadwati some where near Nohar-Sothi-Bhadra in Ganganagar district of Rajasthan (Agarwal and Kumar 1982).

A rich find of copper objects, of unprecedented richness in the history of Indian archaeology has been found in explorations and excavations at a single small site of Ganeshwar in association with OCP from the beginning to the end. The find includes arrowheads, spearheads, beads, bangles, pins including spiral headed ones, celts, balls and fish-hooks etc, numbering about 5000.

It is also been believed that the Pre- and Mature Harappan sites of northern and northeastern Rajasthan and Haryana received copper ingots and objects from the Ganeshwar region (Agrawal 1984: 157). The contention that Ganeshwar copper artefacts are found at Harappa, Kalibangan (Fig. 2), Lothal, Mohenjodaro, Banawali (Fig. 3) and Chanhudaro is backed by spectrometric analysis of the metal, which indicates that some of these artefacts were of pure copper (97%) while others show an alloy of 3-12% of tin (Hooja and Kumar 1995: 330).

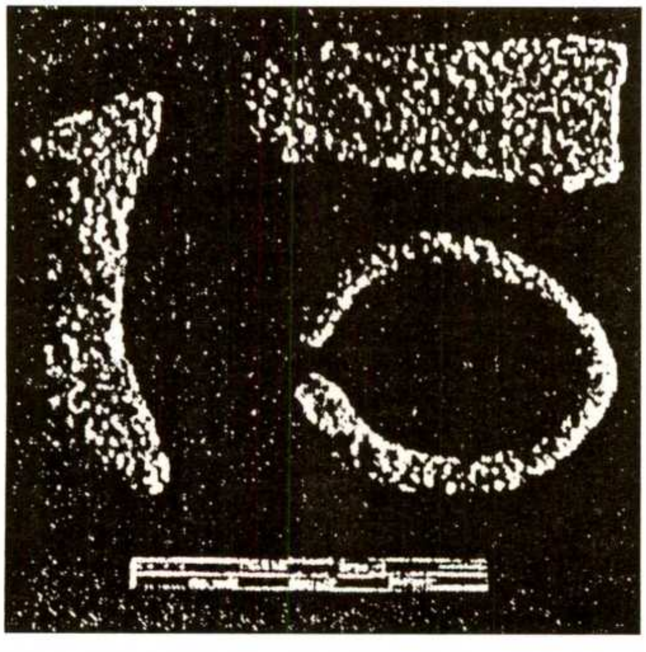

Fig. 2: Pre-Harappan copper objects from Kalibangan

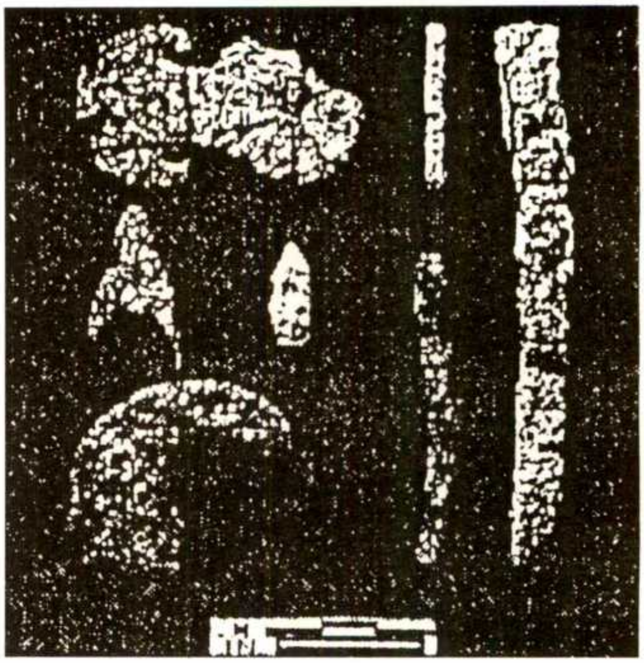

Fig. 3: Harappan copper objects from Banawali

Although, it has been reported that OCP from Ganeshwar and Jodhpura are identical in shape and design (Agrawal and Kumar 1982: 129), we feel that each of the two sites are significant in their own ways. The significance of Jodhpura lies in the fact that the evolution through time and the changes and stages of development of the OCP at the site itself are shown although the cause that brought about this change is not clear. At Ganeshwar the cause of this change is apparent. We intend to highlight it. For this purpose, detailed stratigraphical data of OCP ceramics of this complex is necessary.

At Jodhpura (Kumar 1977; IAR 1972-73: 29-30) the cultural deposit varies from 1 m. to 2.10 m. The deposit is free from water logging and other types of disturbances and four phases were demarcated.

Phase I A: yielded tiny sherds of indecisive shapes, generally rolled, ill fired and without any decoration. No signs of habitation were found.

Phase I B: Higher density of OCP occurs. It is mostly wheel turned and treated with a wash. Fragments of vases, basins, bowls and handles are found good numbers. The sherds are plain without either paintings or any other type of design.

Phase I C: This phase is characterised by the beginning of building activities. Rammed earth floors, reinforced with potsherds rammed horizontally into them, were found along with pieces of burnt daub. In one of the floors, fire-pits with indication that fire has been lit there over a prolonged period, were found.

The pottery in this phase shows some new features. In addition to the shapes of earlier phase, a new variety in the form of knobbed lids also appears. The most frequent shapes are vases with flared rims of different types and sizes. The pottery is, as usual, wheel-made and a thick slip can be noticed on a large number of sherds. The slip is usually orange to deep red in colour although brownish sherds are also found in some quantity. Decorations comprise incised designs, a new feature), such as triangular notches, notches between parallel lines, wavy lines and rectangular lines making a check design. On some sherds faint marks of bands in black or blue paint were noticed.

Phase I D: This phase is characterised by the most evolved phase of OCP. The pottery complex includes a variety of shapes such as storage jars and miniature pots (being the new types in this phase), vases, basins, bowls and lids etc. It seems that handles that were found in the earlier phases have gone out of use in this phase. The decorations now range in three varieties namely (i) painted, (ii) incised and (iii) applique (also a new feature). The pottery shapes and decorations in this phase are comparable with the industry of same kind discovered at Atranjikhera, Lal Qila, Mitathal I and Siswal B.

The most important feature of this phase is the discovery of mud brick structures. It is now self evident that there has been a gradual evolution not only in the pottery but also the structural activities of the people at the site.

The excavations further confirmed the stratigraphic position of unpainted Black-and- Red were which succeeded the OCP and preceded the Painted Grey ware at the site. Similar evidence has come from Noh, Jakhera, Atranjikhera and Sringverpur.

The evidence at Ganeshwar (District Sikar) is also very significant. Ganeshwar is probably the first site in the region to have yielded a large number of painted OCP sherds. The paintings are normally on the rim, neck and shoulders with only a few cases of the painting extending below the belly of the pot. The designs include a thick band on the neck, thin parallel lines on the shoulders, a horizontal band between the wavy lines, oblique parallel lines, a crescentric comb pattern etc. Incised pottery also occurs in large numbers, with the lines deeper and longer. The designs include oblique strokes on cords, crescent like notches, deep dashes, oblique and straight lines and check pattern.

Another significant feature of Ganeshwar OCP is the occurrence of graffiti marks on the potsherds. These include many symbols like trident, hatched quadrangles, ladder etc.

In order to understand the factors responsible for the change and development in OCP complex, it is desirable that stratigraphic evidence of the OCP complex at Ganeshwar is closely examined further.

Ganeshwar (IAR, 1981-82: 61; 1983-84: 71-72; 1987-88: 101-102; 1898-89: 76-78). Vijay Kumar excavated this single culture site in 1981-82. Subsequently P.L. Chakravarti joined him. A 4.15 m thick cultural deposit was divided into three phases.

Period I (Late Stone Age): This period was characterised by microlithic industry, animal bones and stone-paved-floors and outline of circular hut.

Period II (Copper Age): On the basis of material culture, this period was further sub-divided into two, Phases II and I.

Period II Phase (I)

The ceramic assemblage of Period II Phase I was divided into two groups. The first group of pottery was pink to buff coloured, thin walled, soft fired, light ware consisting mainly of small to medium sized kitchen vessels, vases and jars, footed and ring bases, usually with narrow and short incurved rims. A large number of them were painted in black with dots, dashes and curves executed in white. The designs are preponderantly geometrical, consisting of volutes, series of wavy lines, obliques, balls, triangles, crosses and broad bands. In this category was also included a thick sturdy ware represented by basins decorated with incised geometric designs internally. This pottery can be equated with Kalibangan-Sothi complex.

The pottery of second group is finer in texture and surface treatment. It also has black paintings. As has already been pointed out, this category of Ganeshwar pottery is similar to that found at Jodhpura. It was made of well-levigated clay, is well fired and sturdy with an ochrous core. Pottery forms include narrow and wide mouthed jars, small squat *handis*, *lota* like carinated vessels of various sizes, shallow pans, bowls of various sizes and deep basins, a narrow mouthed cylindrical pot and bowl like lid (IAR 1987-88: 102). Pottery in this ware also included dishes-on-stand, basins and troughs, jars, vases and bowls etc. (IAR 1988-89: 77).

Copper implements are very few, and include five arrowheads, three fish - hooks, one spearhead and an awl. Microliths and animal bones also occur in good numbers. Small implements of copper, bone and beads of semi precious stones, terracotta and steatite and bangles of clay and shale were found from this phase. Floors were paved with river pebbles and schist slabs. (IAR 1987-88: 102).

Period II Phase (II)

The principal variety of Ganeshwar OCP of this phase are goblets, beakers, tumblers, handled bowls, elliptical vases, cylindrical vases, lids, jars, offering stands, dishes, basins and miscellaneous type of pottery with pre-Harappan affinity (IAR 1987-88: 102). During subsequent excavation (IAR 1988-89: 77) the pottery types included were, 'S' shaped jars, perforated jars, beakers, basins, goblets, handled cups etc. The pottery was profusely painted and the designs included floral and faunal motifs, intersecting cricles, peacocks, pipal and banana leaves, trees, deer, fish and flowers. It is also very significant that the pottery of the first category in Period II Phase (I) that can be equated with Kalibangan - Sothi Complex is not reported from this phase.

This phase is also characterised by fully developed copper technology. The copper implements are most profuse accounting 99% of the total material. Several hundred copper arrowheads, rings, bangles, spearheads, chisels, balls, celts, etc. were found (IAR 1987-88: 102). In subsequent excavation, besides these objects razor blades, fish-hooks, hair pins and antimony rods were also found. These were usually thin and light. Double spiral headed copper pins found from this phase were akin to the type found in West and Central Asia (IAR 1988-89). Razor blades were also reported in the earlier excavation (IAR 1983-84: 71).

As mentioned earlier there is evidence of mud-brick structure at Jodhpura ID. As evident from the excavations at Ganeshwar the site appears to have been damaged by floods: as a protective measure people had raised three stone platforms in three successive phases (IAR 1981-82: 61). Later on, structures like a mud platform with partitions, storage pits, house floors with post- holes were found (IAR 1983-84: 72). The most remarkable structure in Period II Phase II was a stone embankment raised to protect the settlement from frequent floods. The 3.08 m structure running across the mound from north to south, parallel to the river Kantali was traced to a length of 30 m. The average thickness of the structure was about 4 m. (IAR 1988-89: 72). Thus, Ganeshwar II (i) can be equated with Jodhpura IC and Ganeshwar II (ii) can be equated with Jodhpura ID. Thus at Jodhpura phases IA and IB appear to be are Pre Sothi-Kalibangan, representing the earliest ceramic form of OCP at the site.

At Ganeshwar Phase (i) of Period II has been estimated to begin from 3000 B.C. (Agrawal 1984). As bichrome Kalibangan I-Sothi pottery does not continue in Phase (ii) of Period (i), Phase I of Period II can be equated with Kalibangan I, which has been dated from 2900 to 2700 B.C. on the basis of 14C corrected dates (Lal, 1979: 94). Possehl has recently suggested a date between 3200-2600 B.C. for the Pre Harappan Period (Possehl 1999: 4). This evidence, therefore, suggests that the potters of Ganeshwar started borrowing some pre Harappan shapes and evolving Harappan forms like cylindrical jars, dish-on-stand and bowl like lid in OCP fabric as early as Phase I, in other words, between 3000-2700 B.C. Thus it becomes clear that the process of transformation of OCP into Harappan forms through some borrowings from the Pre Harappans started between 2900-2700 B.C.

In this phase firing, fabric, texture, application of thick slip has also improved. Evolution from OCP towards Harappan styles, while maintaining an individuality by the absence of any bichrome painting tradition or incised pattern on the inner side of the pots is seen.

We find that shortly after 2700 B.C. when Phase (ii) of Period II of Ganeshwar begins, almost all the typical Harappan forms have been produced by the Ganeshwar potter, in the transformed OCP fabric. Thus, in two steps, evolution and production of each and every form of Harappan ware, including the painted motifs like floral, faunal, intersecting circles, peacocks, pipal and banana leaves, trees, deer, fish and flowers has been accomplished. Even the tradition of painting the pot from rim to below the belly along the tradition of putting graffiti marks on the potter is adopted from the Pre-Harappans at Ganeshwar. Graffiti marks on Pre-Harappan pottery is reported from Kalibangan I (Lal 1979:75).

It is also significant that in spite of the fact that Pre Harappan Fabrics C and D were the closest to the Harappan ware as pointed out by Lal (1979: 72-73), we do not find Harappan ceramic forms emerging at Kalibangan I or say any other Pre-Harappan site of Kalibangan I-Sothi Complex. Thapar (1973: 266; 1984: 18) was very emphatic that the form of Indus civilization does not seem to have been locally developed at Kalibangan, including the ceramic forms.

The Ganeshwar evidence indicates not only there is a tangible evidence to establish a genetic relationship between the Ganeshwar OCP and Harappan ware, but also that the OCP is itself getting transformed into the monochrome Harappan ceramic complex. From this it is logical to infer that the mighty Harappan Civilization, in its pre-urban stage is taking its birth at Ganeshwar.

Not only is the Harappan ceramic form found emerging here but there is also a hint of its architectural forms finding its roots here. It may also be significant to recall that D. P. Agrawal is trying to find the form of Harappan metal technology emerging here. He is even inclined to identify Ganeshwar as the Meluhha of the Mesopotamian texts. (Agrawal and Kharakwal 1999).

The site of Kunal in district Hissar of Haryana provides corraborative evidence although the nature of evidence is slightly different. The evidence is significant as it comes from the Saraswati Valley and therefore, requires detailed treatment.

Kunal ($29^0 30'$ N and $75^0 41'$ E) is located on the left bank of now dried up Saraswati. It was excavated by Khatri and Acharya (1994-95; IAR 1985-86: 23-25; IAR 1991-92: 37-39). It covers an area of 3 acres and the cultural deposit is 3.10 m thick. It is about 20 km from Banawali, also situated on the bed of the Saraswati. The proto-historical deposit has been classified into three successive phases of Pre-Harappan culture.

Phase I: The pottery repertoire is dominated by Hakra ware and is devoid of several Kalibangan fabrics although bichrome painting is present. It has also a hand made black-and-red ware.

The link of this site with Jodhpura-Ganeshwar region in this phase is attested by its material culture, which is represented by large number of bone tools, micro-beads of chalcedony and copper implements such as arrowheads and fish hooks. It may be noted that a number of arrowheads resemble those found at Ganeshwar, in Rajasthan. The two sides of the arrowheads show a marked curvature at the base. The other type is of course, the usual inverted 'V' shaped, with sides absolutely straight.

Period I B: The pottery repertoire of Period IA continues to occur in large numbers mainly the bichrome red ware. The black-and-red ware continues to occur in small quantities. The excavators observe:

"But what is most significant from our point of view is the first occurrence of red sturdy ware pots of well levigated clay. Some of these pots have forms closer to the classical Harappan forms, such as beakers and jars. We have clearly observed the beginning of Mature Harappan shapes, fabrics, thickness etc., but in dull red ware gray ware and the dull chocolate ware" (Khatri and Acharya 1994-95: 95). From this level, terracotta cakes were also found. This is the first and the earliest evidence of the occurrence of Harappan ceramic forms in the Saraswati Valley. It may have arrived at Kunal from Ganeshwar along with the copper objects mentioned above. Kunal is located at a tri-junction of three great and widely distributed cultures namely Kotdiji-Kalibangan I, Black-and-Red ware and Harappan (Ganeshwar OCP). At a later stage the last one is found impinging upon the territories of the former two cultures.

Period I C: Period IC has been classified into three structural sub-phases IC (i), IC (ii) and IC (iii). These structural phases also exhibit features that demonstrate developing stages of culture, indicating 'change with continuity'. Brick sizes are in two ratio 1:2:3 and 1:2:4 both used simultaneously. Drainage in the form of soakage jar fixed in the street pits, indicate that Mature Harappan technologies started appearing in the Early Harappan times. Plastered round silos or pits for storage of grain are attested. In this phase well-built houses along streets were also found. A water channel was also constructed in this phase. A few fire pits were also traced.

All the potteries of Period IB continue in Period IC (i). The emergence of many new forms which are found extremely popular during the Mature Harappan period is of great importance. 'The occurrence in significant numbers of dishes-on-stand, perforated jars and globular jars with ring bases, thick walls, well levigated clay, red core, etc. lead us to conclude that one more big step was taken in IC (i) towards the achievement of what is called classical Harappan pottery repertoire. We have now even animal and bird motifs in painting, for example, horse, peacock, bull, cranes etc'. (Gupta 1997: 134).

The objects recovered from this phase reflect the material prosperity and long distance trade. In one of the rectangular houses of Phase IC (i) a virtual treasure of gold and silver ornaments placed in a silver sheet and buried in a plain simple dull red globular pot of early Harappan fabric was found.

The silver objects included two *tiaras* one small and one large, each with a large fully opened flower having petals topped with a decoration like the Greek letter *alpha*. Along with these silver objects, one large silver armlet with horizontal mouldings was also found. From a different *cache* from a different house of the same period a large number of gold ornaments with disc beads, cup shaped discs, round sheet beads with thread channel, barrel shaped tubular beads with facets all over the surface have also been found. Terracotta beads identical with metal ones are also found. Similarly a large hoard of lapis-lazuli micro-beads and 92 beads of agate make the whole gamut of luxury items.

Significantly, copper objects of the mature Harappan types included coiled finger-rings, coiled cones, inverted 'V' shaped arrowheads, flat axes, fishhooks, spearheads etc. There is at least one copper-smelting furnace at the site. A classical example of terracotta crucible with molten metal still sticking to the inner surface has come to light. Undoubtedly the copper ingots came from some other site but the objects were manufactured locally. Similarly one pottery kiln was also brought to light.

One of the significant discoveries was also six steatite seals and one shell seal with knobbed back with a hole. The seals however, bear only geometric designs. At Dholavira in Kachch, where stage III, also a transitional phase, has yielded four steatite square seals with pictures of typical Harappan human, animal and floral motifs.

Period IC (II): Period IC (II) witnessed further elaboration in the cultural complex of IC (i). We have similar mud brick houses with kitchen and toilets, drains, dull red monochrome and bichrome pottery, pots with broad dark bands on the neck, globular jars with flanged mouth meant to receive covers, dish-on-stands, perforated jars, globular jars, basins etc. However, one item which may have been introduced in Period IC (i) times becomes very significant one now. It is the construction of a water-channel, a little more than 20 m of whose length has been traced (Gupta 1997: 134-135) which brought fresh river water upto the middle of the habitation.

While analysing the above mentioned evidence from Kunal Gupta (1997: 135) holds that however, as at Kalibangan, Banawali and practically all the major bichrome and monochrome sites, the Sothi-Kot Diji pottery of the earlier phases continues to occur in sufficiently large numbers and varieties to warrant the conclusion that neither the culture nor the people changed. It was a perfect example of self-transformation with slow growth, innovations, adaptations, and proliferation of long-distance-trade-network in which the settlement participated.

We would like however to draw a slightly different conclusion. In a static society where neither culture nor people were changing, to bring a transformation of this magnitude, an external catalytic agent would normally be required. In the case of Kunal we find that this catalytic agent was introduced in Period IB, itself, in the form of the first occurrence of red sturdy ware pots of well levigated clay, having forms closer to the classical Harappan forms such as beakers and jars. In the light of the transformation of Ganeshwar ceramic complex as discussed above, we would prefer to identify the sturdy red ware having typical Harappan forms conspicuously introduced in Kunal IB with the transformed Ganeshwar OCP as imported or intruded feature here. This is more so, because almost every mature Harappan ceramic form is found attested at Ganeshwar in Phase II of Period II. The transformation of the Ganeshwar OCP had already started in Phase I of Period II. Alternatively this pottery of Kunal is not likely to be identified with any other pottery in existence in this region at that point of time. In fact there is no genetic relationship between the potteries of Kalibangan I-Sothi Complex and the Harappan (Dalal 1987: 79; Thapar 1973. Chaolong 1990). Agarwal (1982: 141) rightly believes that 'the Harappan abruptness was deliberate and not a process of natural growth'. The occurrence of Copper-Hoard affiliated copper objects including the Ganeshwar types particularly the broken arm of the anthropomorphic figures, erroneously identified as razor or hook (Figs. 3-4), bangles, fish-hooks, *Parasu*, bar-celts and-arrow heads at the respective sites like Mohanjodaro, Kalibangan, Banawali and Khataoli and Lothal in Mature Harappan levels, also corroborate our view.

Thus, the evidence at Kunal IB may represent the physical presence of Ganeshwar people at Kunal and may indicate a further strengthening of the relationship between the two people in a mutual give-and-take-bond. This point needs further elaboration.

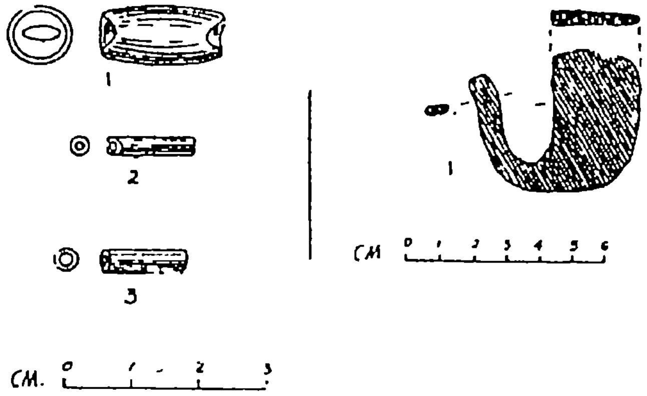

Fig. 4: Antiquities from Khatasli

There is sufficient evidence in Kunal IA that people in this level were importing copper tools from Ganeshwar. In IB there may not be any difficulty in accepting that Ganeshwar people may have arrived here physically to accentuate the copper trade between the two regions. It may be due to this reason that shortly after in IC (i) there is a partial transfer of copper technology to Kunal where instead of mere tools now ingots are being imported from Ganeshwar, for local manufacturing of tools in the crucibles and furnaces found there. Here the views of Agrawal (1984: 157) stands confirmed that the Mature Harappan sites of northern and northeastern Rajasthan received copper ingots and objects from Ganeshwar region.

This control of copper trade both at Ganeshwar and Kunal must have made the position of the Ganeshwar people at Kunal fairly significant and dominating i.e., in the Saraswati valley, as demonstrable at Siswal, where the pre-urban Harappans established their domination in Siswal B. Probably, this may have been the process through which the Ganeshwar OCP people could have become the founder fathers of the Mature Harappans and masters of the urban phase in the Saraswati Valley.

It is also a very significant coincidence that soon after the arrival of the Ganeshwar people at Kunal in IB, faster all-round growth is visible in Kunal IC (i). Growth and development is visible in ceramic forms and in the total complex including architectural and industrial activities. Steps are being taken to improve the civic life of the settlement through drainage etc. and harnessing water resources. There is the apparent growth and effervescence in industrial production, particularly in terracotta, bone, semi-precious stones, ordinary stones for household use, and metallic objects. Lapis lazuli beads in hoards attest to long distance trade. The prosperity and wealth is conspicuous by the presence of gold and silver exotic objects and ornaments, including the royal *tiara* and luxurious items.

Perhaps this birth of the mighty Harappan civilization was due to the fusion of two widely positioned separate ethnic groups namely the Kotdiji-Kalibangan I and OCP people. This is best illustrated first at Ganeshwar and then at Kunal in the heart of the Saraswati valley. Perhaps this is the best model to demonstrate and suggest that the mature Harappan resulted from rapid, even sudden, fusion of various ethnic groups (Shaffer and Lichtenstein 1989) but not in the lower Ghaggar-Hakra valley (Cholistan) or in Pakistan but in the heart of the Saraswati Valley in Haryana and Ganeshwar in Rajasthan.

Siswal-Late Siswal Complex

Before we proceed further to examine some other aspects of this mighty culture in its transitional and pre-urban phase it may be desirable to examine the evidence from sites of the pre Harappan period, named as Siswal and Late Siswal phases.

These phases are known mainly from two sites, Siswal situated on the Saraswati and Mitathal situated on the Drishadwati which were excavated by Bhan (1971-72; 1973; 1975). The ceramic complex of Siswal A has been equated with Kalibangan I-Sothi Complex, by the occurrence of bichrome pottery and its associated types. Bhan had discovered about 16 sites of this culture in southwestern part of Haryana and adjoining northern Rajasthan. It extends to Jind and Paoli in the northeast.

Siswal B/Mitathal I, has been rightly equated with Jodhpura OCP (Kumar 1977) distinguished by a late phase of Kalibangan I. However, the ceramic complex is characterised by the continuation of a limited variety of Siswal A pottery and the introduction of a sturdier variety painted generally with black bands over a matt surface. The use of white pigment in painting is conspicuous by its absence. The ceramic types and designs lack variety. There is the occurrence of a few classical Harappan shapes such as scoured goblets, beakers, dish-on-stand and perforated jar, but according to Suraj Bhan 'in the otherwise non Harappan culture complex'. Some of the sherds also bear graffiti marks. Since Mitathal I is succeeded by the Urban Mature Harappan phase in Mitathal IIA, Phase I may be equated with the transitional phase of Banawali, Kunal and Ganeshwar Period II Phase I, and may be taken as the pre-Urban phase.

Similar evidence comes from Balu in district Jind of Haryana excavated jointly by U.V. Singh and Bhan (IAR 1978-79; 1982; IAR 1983-84: 29) and Rohira in Sangrur district of Punjab, excavated by G.B. Sharma and Manmohand Kumar (IAR 1982-83: 65; Sharma and Kumar 1980-81). The same story gets repeated, site by site – Pre-Harappan succeeded by the Harappan. Siswal B/Late Siswal/Mitathal I ware was recovered from 32 sites, most of which were located in the Drishadwati and Yamuna. Its expansion is noticed as far north as Sarangpur, under the shadow of Shivalik hills, to the north of Chandigarh. In the union territory of Delhi, this pre-urban-Harappan phase is represented by Dhansa (Bhan and Shaffer 1978: 67) an excavated site. Further south such sites extend up to the Gurgaon district of Haryana adjoining the districts of Mathura, Bulandshahr and Aligarh in U.P. Since both the phases A and B at Siswal are identifiable with two well defined cultural phases at several sites, in a much wider area as mentioned above, the use of terminology, such as Siswal A or Late Siswal pottery/ware may now be discontinued. Its continued use may tend to create confusion. It may now be designated as pre-Urban phase.

The above mentioned survey of data from excavated and explored sites substantiates that the Harappan culture not only originated in India through a natural growth process but was also deeply rooted in the soil of India. Therefore, the hypothesis that this 'Civilization began in Pakistan and North Western India, in the middle of the third millenium B.C.' (Possehl 2000:110) may now be qualified. Nor was the Harappan culture, a transplant from Mesopotamia or any other foreign country. The data further substantiates the division of Harappan complex into two successive phases, (i) transitional/pre-urban and (ii) urban. The first i.e., transitional phase, should have been of longer duration, not only to allow time for the vertical transformation and progress as demonstrated at Ganeshwar and Kunal but for its wider distribution in space as found in Kachch (Dholavira) and Gujarat (Padri) and Vagad (Sonawane and Ajithprasad 1994: 133) but somehow this pre-urban phase is not attested at Kalibangan and Binjor. This time-duration is however, not uniformly attested in the stratigraphic records. Perhaps Agrawal (1971: 236-242) may be right in visualising it as an explosive evolution'.

It is in this pre-urban phase that Kalibangan I-Sothi complex people appear to have been vanquished as at Siswal B. At the same time new settlements are found emerging as indicated by Mitathal, Balu and Dhansa. Where the thick and sturdy pottery bears only monochromic painting in the lower levels.

Many scholars (Wheeler 1968: 24-25; Gupta 1975-76: 144) have pointed out that the urban growth of the Harappans was sudden and swift, but seldom has the nature of its quick process been discussed. We would tentatively ascribe it to a political factor. The political factor strikes me because I don't forget the tantalizing discovery of silver *tiaras* from Kunal IC (i), when Harappan forms have got established on sound foundation. It reminds me of conquests made in the same locale by Sudas described in the *Rigveda*-but simply as a model. The Harappan culture may or may not be identified with the Rigvedic Culture, but the model of the conquests of Sudas over several tribes situated in far and wide regions, may explain the process of expansion of Harappan Urban phase, which is associated with elaborate fortifications, town planning, foreign trade and introduction of script. Shaffer and Lichtenstien (1989:123) has used the most appropriate term 'rapid territorial expansion' to express the Mature Harappan urban phenomenon.

Bara Ware

The OCP was taken to be Late Harappan because of its association with Bara Ware (Bhan 1971-72) therefore let us examine the chronological position of Bara Ware. The site of Bara (30°17'N; 76°47'E), from which the pottery derives its name, is situated on the left bank of a monsoonal rivulet known as Budki Nadi was excavated by Y.D. Sharma in 1951 and again in 1971. The area covered by the site is 550 x 300 m with a 4 m thick deposit, divisible into three phases IA, IB and IC. The earliest phase, IA is free from any Harappan influence. This is also the case with Dher Majra on the right bank of the Sutlej: The characteristics of the pottery, its chronological horizon, comparable shapes, painted designs and extent were thoroughly discussed by Y.D. Sharma (1964; 1965; 1971-72; 1973; 1982; 1983 and 1987). According to Sharma (1983) Bara culture had a long span. On present showing its long span may perhaps be divided into four phases: Bara (early levels), Dher Majra and Sanghol are exclusive Bara culture sites with only minor cultural contacts. These sites along with Mahorana indicate its pre Harappan context. In contemporaneous Harappan context Bara ware is found at Banawali II, Mitalhal II A and Rohira. In a post-Harappan context it is reported from Banawali III, Mitalhal II B and Kunal II. In its last phase it coexists with PGW (Bhagwanpura, Dadheri and Kat Palon). The picture (Lal 1997: 268) in the Upper Sutlej Valley is 'that in a milieu of local pottery tradition termed Baran, that Mature Harappan made its appearance. However, in due course of time the Harappa element became feeble but the thrust of Barans conlimied'.

A similar situation in which local cultures, precede, coexist and survive the Mature Harappan has also been noticed in Gujarat. Here the Black-and-Red ware is found preceding the Harappan ware at Prabhas Patan and Padri (Sonawane and Ajitprasad 1994: 132). It is found coexisting with the Harappan ware at Rangapur, Lothal and Surkotada IB. It is found surviving in a dominating at Surkotada IC. A similar life span of another local culture characterized by 'Gritty Red Ware' has also been noticed in north Gujarat (Sonawane and Ajitprasad 1994: 135).

Bara Ware extends from the Sutlaj to the Gangetic doab (Lal Qila) where again it is almost free from any influence of the Harappan ware. Thus the association of Bara Ware with the OCP does not necessarily make either of them 'Late Harappan'.

The Barans were the food producers and played not an insignificant role in sustaining the Harappan Urban fabric through surplus agricultural production. (Sharma 1987).

With the decline of the Harappan trade and culture, the Barans managed to survive thereafter, as evidenced at Banawali, Mitathal and Balu and various other sites of Punjab, Haryana and upper Ganga-Yamuna *Doab*.

Reverting back to the Ganga-Yamuna *Doab* it may be pointed out that the OCP here also appears to have undergone phases of change and development. The excavations at Hulas (Dikshit 1982; and IAR 1982-83: 100-103) and Khataoli (Margabandhu and Sharma 1987) indicate three stages of its protohistoric cultural development. Three phases of the OCP were also visualised by the present author (Sahi 1983, 1994: 68) – Pre Harappan, Harappan (including both pre-urban and urban phases) and later. Khataoli in Distt. Mahendragarh of Haryana is situated on the right bank of Sahibi. This insignificant site has yielded a copper object from the middle level (Layer 3) ascribed to Harappan period. The excavators (Fig. 4) have identified it as hook. But in fact, it could be identified with the broken arm of an anthropomorphic figure, belonging to the Copper-Hoard group. If our identification is accepted, Khatoli becomes the second site after Saipai to yield Copper-Hoard object in a stratified deposit, that too, ascribable to the Harappan period, besides Lothal. Banawali can thus be taken as the third site (Fig. 3), in northern India.

From Saipai, a small microlithic chalcedony blade has been reported (Lal 1971-72). From a recently discovered single culture OCP site, Chandaukha in Dist. Aligarh a small fluted core of chert and a granite (?) blade has been found. Such sites may be placed in the pre Harappan phase of OCP identifiable with Ganeshwar Period II Phase I. The site of Chandaukha has also yielded a water-well, paved with wedge-shaped handmade burnt bricks with three parallel hand-grooved marks. The brick measures 31 x 24-19 x 6.5 cm.

Moreover, certain flat celts and shouldered celts, similar to those found at Ganeshwar-Jodhpura, with round indentation marks have been found at Pariar, Bithur, Bahadarabad and Nasirpur, as pointed out by R.C. Agarwal (1987). A flat axe from Haswa (Distt. Fatehpur) with round indentation marks, was also found (K. Kumar 1997). This also indicates an early phase of OCP/Copper – Hoard, Coeval with Ganeshwar-Jodhpura phase.

It may also be significant to note here that OCP people of the Ganga-Yamuna *Doab* had also discovered an additional source of copper from Karai copper mines in Kumaon region. At Bankot, which is just 12 km from the copper mines, about seven anthropomorphic figures were found. Other sites yielding such figures are Haldwani, Bisoli, Sheorajpur, Etawah, Bulandshahr, and Chandausi

(Dubey and Pant 1997: 259) in addition to the one reported from Lothal. The possibility of the occurrence of broken arms of anthromorphic figure in mature Harappan context has already been discussed above.

The early Pre-Harappan phase in the Ganga-Yamuna *Doab* is also corroborated by TL and ^{14}C dates from Jhinjhana (2650 B.C.) and Hulas (3000 B.C.), Harappan phase is indicated by Hulas (2460 B.C.), Atranjikhera (2280 B.C.) and Lal Qila (2030 B.C.), where as Nasirpur (1500 B.C.) determines the last phase. The characteristics of each phase may further be worked out.

Thus OCP of the Ganga-Yamuna *Doab* appears to have developed in the same way under a sympathetic vibration, as it was developing in the Ganeshwar-Jodhpura region and the Saraswati valley. From the pre-Harappan stage it developed to the Mature Harappan stage and Hulas and Alamgirpur were the outpost towns of urban phase, wherein the Bara element peacefully coexisted. The existence of the predominantly rural settlements of Ganga-Yamuna *doab* may be viewed as lucrative as well as essential for providing surplus agricultural production for sustaining the contemporaneous Harappan urban centres situated just on the west side of the Yamuna, through intermediary stations like Alamgirpur and Hulas.

Therefore, how can we classify the Ganga-Yamuna *Doab*, to have been in a state of decay and degeneration, if its wealth and prosperity is reflected through treasure-troves of gold and silver object in several kilos, as was recently discovered at Mandi in Muzaffarnagar District, though its cultural affiliation is still uncertain. However, the Mandi finds along with the quantum of Copper-Hoards objects may as well represent the properties of the rural settlements in this region, which appear to have been washed out by floods of great magnitude.

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Some Metallurgical Aspects of an OCP Period Copper Hoard

R. Balasubramaniam, M.N. Mungole, V.N. Prabhakar[1], D.V. Sharma[1] and D. Banerjee[1]

Department of Materials and Metallurgical Engineering
Indian Institute of Technology,
Kanpur 208 016

1 Archaeological Survey of India,
Agra Circle, Mall Road,
Agra 282 001

Abstract

The material of construction (Cu) of an ancient Indian ochre coloured pottery (OCP) period (2650-800 B.C.) anthropomorphic figure has been characterized by optical and scanning electron microscopy, and microhardness measurements. The green surface patina was analyzed by X-ray diffraction as a mixture composed mainly of cuprite and minor amounts of malachite and brochantite. The copper possessed a highly heterogeneous grain structure consisting of equiaxed grains (of size 30-40 mm) and entrapped second phase particles of spherical shape. The identification of equiaxed grains with straight annealing twins, coring and the spherical shape of the inclusions indicated that the anthropomorphic figure had been cast to shape without any further working operation. The relatively low microhardness (65 to 80 kg/mm^2) of the sample further confirmed that the sample was a cast structure. Local compositions from several different locations in the metallic matrix and the entrapped inclusions were obtained using an electron probe microanalyzer. The composition of the metal was almost pure Cu, with minor impurities of C and Sb. The major elements identified in the second phase particles were Cu, Pb and S, which indicated that these particles were sulfides. The presence of these sulfides has been discussed in with respect to the Cu extraction process.

Introduction

Although copper hoard objects have been discovered over a large part of north India, the concentration is mainly in the Indo-Ganga Divide of western Uttar Pradesh and the Chhota Nagpur region of Jharkhand (Lal 1951). Ochre Coloured Pottery (OCP), first identified by Lal (1951) during his excavations at Hastinapur (Lal 1951), has been found in the same stratification as the copper hoards (Lal 1971-72), thereby suggesting a connection between these archaeological sites. Bharadwaj (1979) places this period between 1100-800 B.C., while Thermoluminescent dates from several OCP sites indicate a time bracket from 2650 to 1180 B.C. (Dikshit 1979). The copper hoards usually contain implements like celts, hatchets, harpoons, spearheads, antennae-hilted swords, rings, harpoons and anthropomorphic figures. Of the objects recovered from sites in Haryana and Uttar Pradesh anthropomorphs, harpoons and swords.

The identification of copper hoard objects with an archaeological culture is still elusive. There are several theories associating these hoards with the Indo-Aryans and refugees of the Harappan civilization (Lal 1951; Piggott 1950; Ghosh 1989). Although the objects found in the hoards could be explained on the basis of their functions, a proper identification of anthropomorphic figures has been difficult. Before the discovery of anthropomorphic figures reported in the present study, only fourteen such figures, of which two were mere fragments (Kumar 2000). Therefore, the discovery of 31 such figures in 2000 A.D. from an agricultural field near Madarpur village, Thakurdvara tehsil, Moradabad district in Uttar Pradesh assumes considerable significance (Fig. 2). Twenty-eight of these figures are shown in Fig. 3, the remaining three are in the National Museum, New Delhi. Six figures had their hands broken. The size of the figures variable. The legs were now shown below the cavity below the abdomen. Two of the figures had their right hand raised indicating *abhaya-mudra* in which Hindu deities are generally depicted. The present discovery is also the first instance of copper hoard in which have been found.

V.N. Prabhakar and D.V. Sharma examined the find spot. OCP sherds were collected from an area of nearly 200 ↔ 200 m. A small trial pit, in an area of 2 ↔ 2 m, was dug adjoining the find spot. The trial dig also revealed

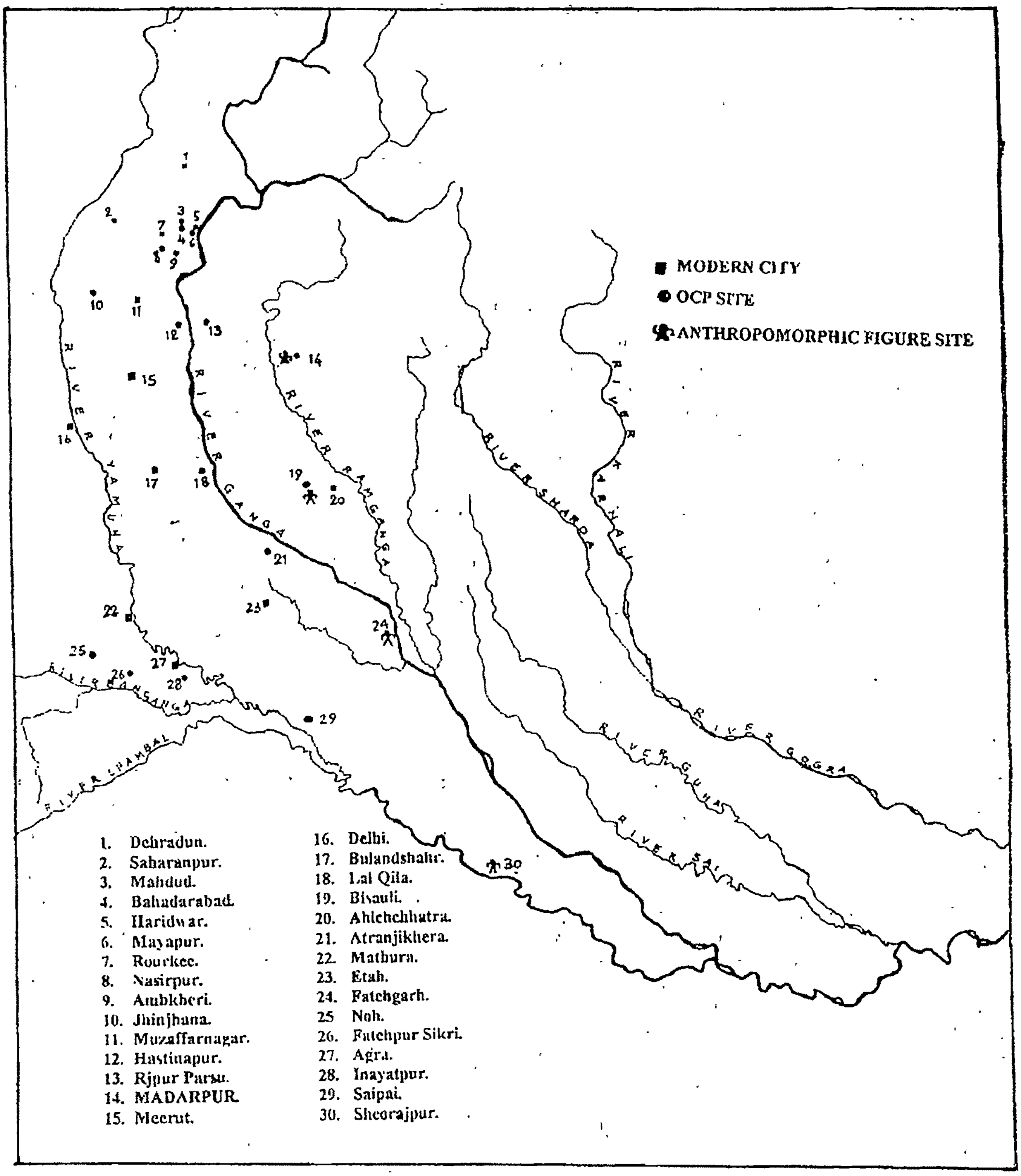

Fig. 1: Map showing the important OCP sites and occurrence of anthropomorphic figures

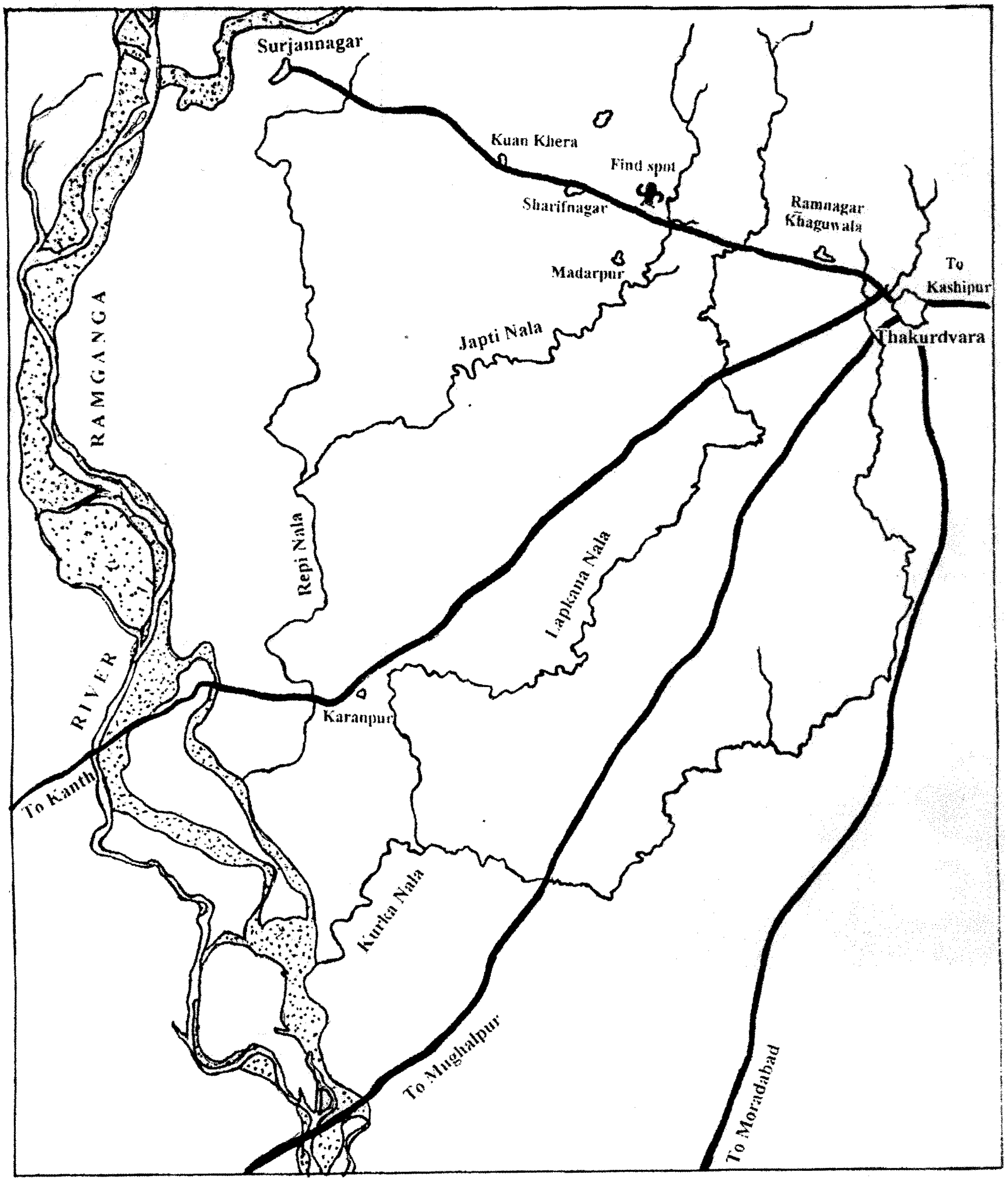

Fig. 2: Map showing the recent discovery and river system in the vicinity

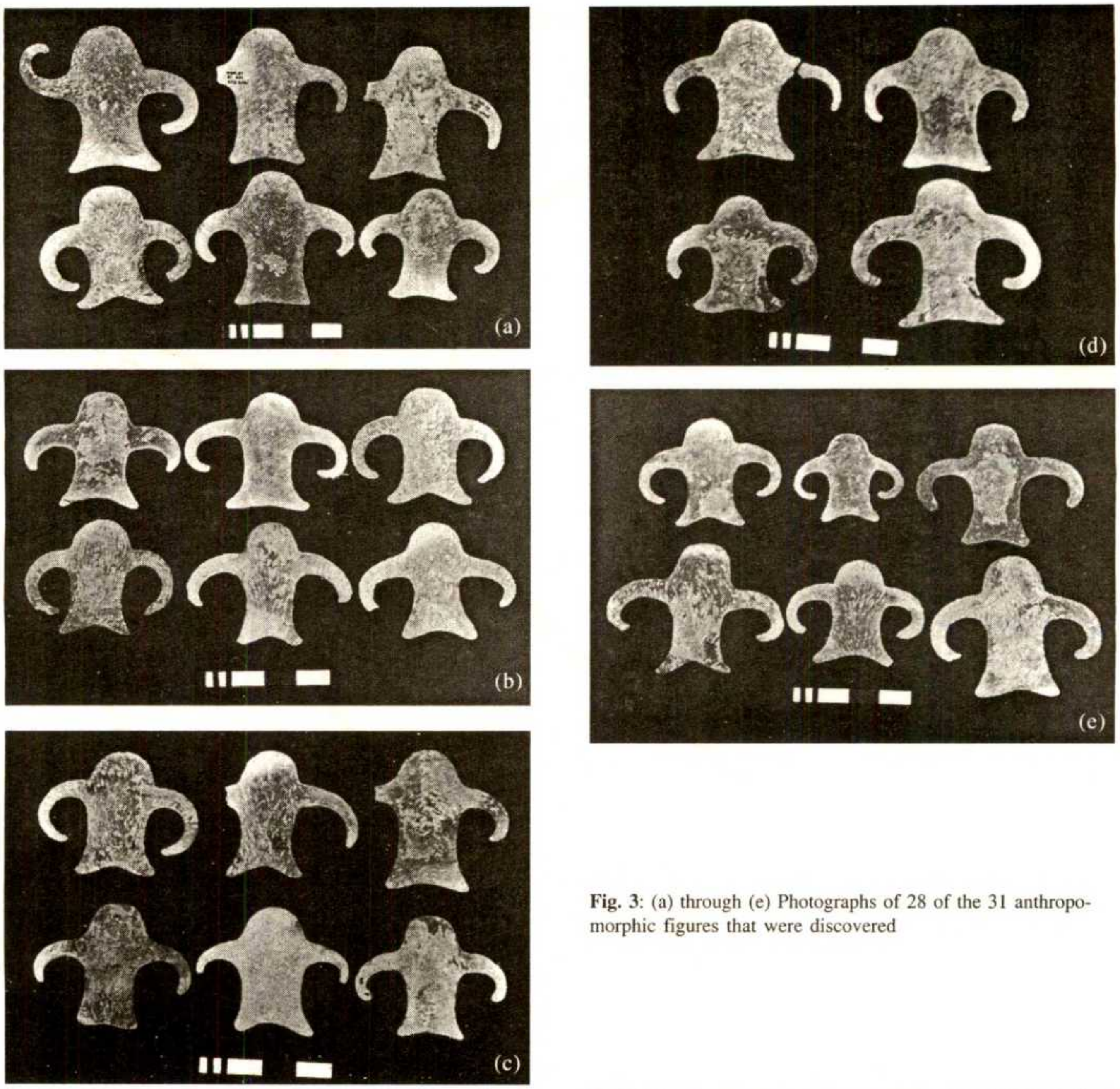

Fig. 3: (a) through (e) Photographs of 28 of the 31 anthropomorphic figures that were discovered

the presence of OCP in a thin layer of nearly 5 cm in thickness. Moreover, considerable amount of OCP could be collected from all the exposed area of the field. The OCP compared well with that from other sites in terms of color, fabric, friable nature and peeling of color from the surface. The discovery of the 31 copper anthropomorphic figures has provided scope for study of OCP and copper hoards afresh. The aim of the present study is to characterize the material of construction of one of the anthropomorphic figures and to obtain insights on its metallurgical processing.

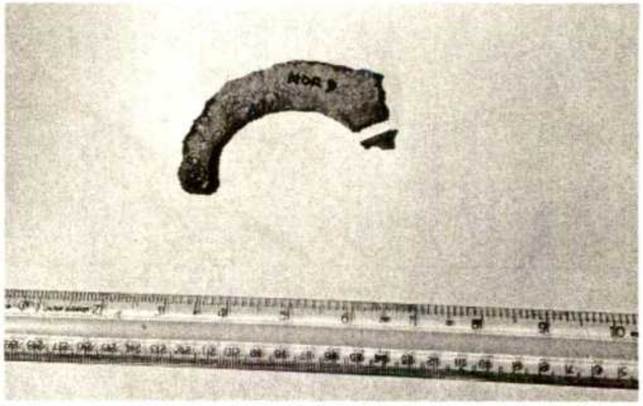

Fig. 4: Macroscopic view of the broken arm of one of the figures that was utilized for the present analysis

Experimental Procedure

A broken arm of one of the figures (Fig. 4) was analyzed. It was curved and its thickness was approximately 3 mm. The object was covered with a relatively thin light green scale. In order to understand the nature of the scale, X-ray Diffraction (XRD) patterns were obtained from the surface in a Rich Seifert X-ray Diffractometer using Cu Ka radiation. The patterns were analyzed in order to obtain insights on the surface scale nature.

A small portion of the figure was sectioned (Fig. 4) and two sections were prepared for metallographic analysis, one parallel to the surface and the other perpendicular to the surface. They were mounted and prepared for metallographic observations by initial polishing on emery paper in dry condition and finally with alumina (1 mm) in water suspension. The polished samples were etched with ferric chloride at room temperature to reveal the microstructural features. The microstructures were observed in an optical microscope and a JEOL 840A Scanning Electron Microscope (SEM). Elemental analyses were obtained at several different locations in the sample using a JEOL 8000 JXA electron probe microanalyzer (EPMA). The microhardness variation across several sections was measured using a Carl Zeiss Jena 160 microhardness tester with a 40 gm load.

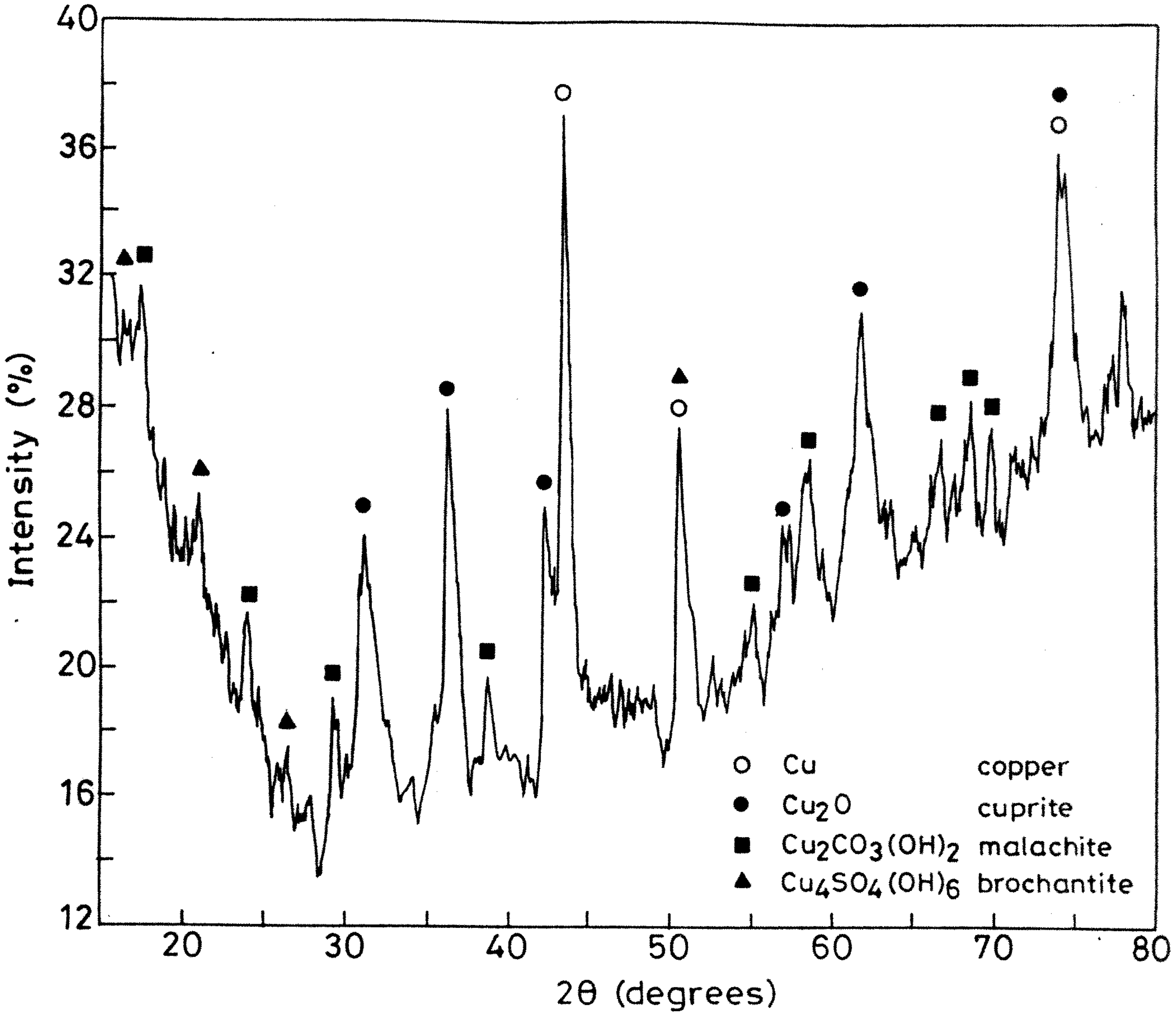

Fig. 5: X-ray diffraction pattern from the surface of the Cu anthropomorphic figure. The peaks corresponding to the identified phases have been marked

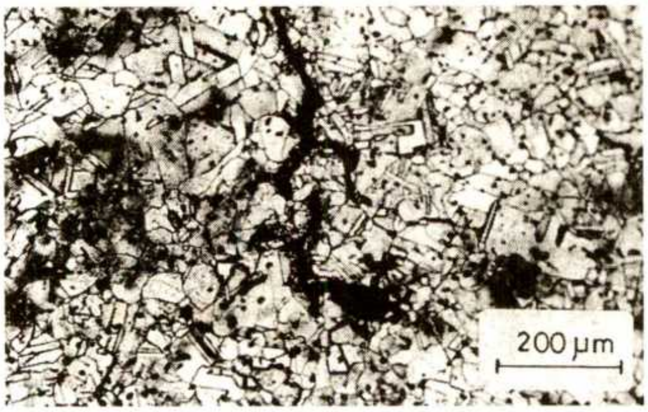

Fig. 6: Optical micrograph of the sample showing presence of a macrodefect (crack). Notice the relatively uniform grain structure

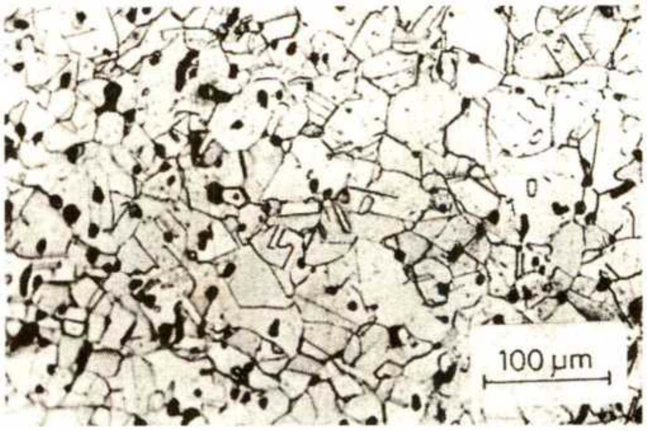

Fig. 7: Optical micrograph showing equiaxed grains and entrapped slag inclusions of spherical shape. The presence of straight annealing twins in some of the grains can be noticed. The microstructure represents a typical cast structure

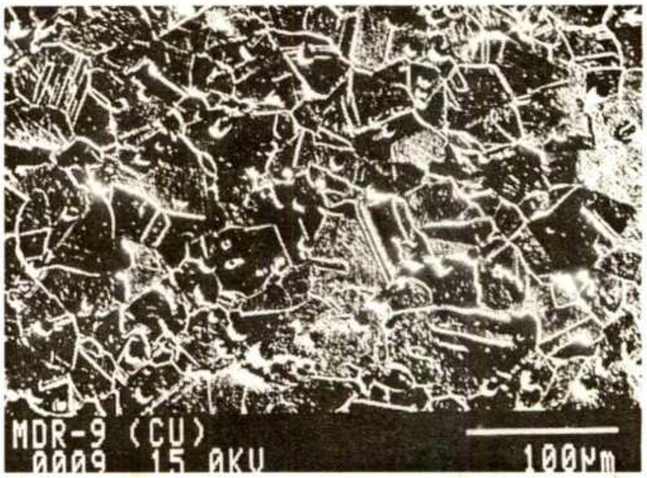

Fig. 8: SEM micrograph of structure showing spherical-shaped sulfide inclusions in almost pure copper matrix. Coring can be observed in some grains.

Results and Discussion

X-ray diffraction analysis

The X-ray Diffraction pattern obtained from the surface scale of the object is given in Fig. 5. The peaks were compared with that of the common corrosion products of Cu using JCPDS (1996) files. Apart from peaks due to the substrate Cu, they could be indexed to the corrosion products, identified in Fig. 3. Based on the peak intensities, it can be concluded that the major corrosion product was cuprite (Cu_2O, JCPDF 34-1354), while the minor corrosion products were malachite ($Cu_2CO_3(OH)_2$, JCPDF 41-1390 and 10-0399) and brochantite ($Cu_4SO_4(OH)_6$, JCPDF 43-1458). The occurrence of cuprite as the major corrosion product is reasonable as the specimens were not exposed to the atmospheric environment. Therefore, the known end corrosion products of Cu on atmospheric corrosion (namely, strandbergite, posnjakite, langite, antlerite, brochantite, nantokite and atacamite (Leygraf and Graedel 2000)) were not observed in significant proportions in the patina. The identification of minor amounts of malachite and brochantite is indicative of the corrosion of the object. It is interesting to note that malachite is not a common atmospheric corrosion product of Cu and is sometimes found as a patina constituent of ancient objects (Leygraf and Graedel 2000).

Microstructural analysis

Optical microscopy indicated several macro defects like wide cracks in the cross section of the specimen, like wide cracks (Fig. 6). The grain structure was equiaxed and a non-uniform distribution of second phase particles was observed in the matrix (Fig. 7). There were several grains in the structure where straight annealing twins were present. This indicated that the structure had not been deformation processed because annealing twins were straight and not bent (Scott 1991). Secondly, the second phase particles were rounded and spherical in shape and not elongated, further proving the absence of any deformation processing (Scott 1991). Further, the equiaxed grains did not exhibit any indications of deformation (Fig. 7). They revealed in both parallel and perpendicular sections to the surface the casting route of the manufacture of the object. The grain size was not strictly uniform and a detailed analysis in the microstructures indicated that it was in the range of 30 to 40 mm.

Scanning Electron Microscopy of the polished and etched sections also revealed similar features (Fig. 8). Coarse dendritic structures (fernlike growth) were noticed in some of the grains. As faster cooling results in finer dendrites, the presence of relatively coarser dendrites indicated the relatively lower cooling rates after the casting process. Features indicative of coring (and the presence of dendrites) confirmed that the object was a cast structure. There was no preferential grain growth, like columnar growth, thereby eliminating chill casting of the object. Moreover, the presence of dendrites negates annealing (Scott 1991) and, therefore, the objects were cast structures. The second phase particles were nearly rounded in most of the cases (Figs. 7-8), thereby indicating that the material was molten and then cast into moulds. In the process, the second phase particles assume spherical shapes based on surface energy considerations. This aspect of coagulated second phase particles in ancient Cu objects indicating them has been addressed elsewhere in detail (Ryndina and Ravich 2001). The results of the present study are in conformity with the detailed study of copper hoard implements by Agrawal *et al.* (1978), who had concluded that the objects were cast in closed moulds. They also noted the skill of the metal casters. In the present study it was confirmed that the objects were manufactured by the casting process. This is by observation of depressions on the surface of the objects which indicate shrinkage of the objects after they were cast into shape.

Another significant feature observed in some of the anthropomorphic figures is the presence of gouging or chevron markings on the flat surface (Fig. 3a, No. 4). This indicates that secondary operations (smoothening and gouging) were performed on the initially cast objects. The functional and religious aspects of chevron markings and other features of anthropomorphic figures have been described in detail elsewhere (Kumar 2000). It is interesting to note that seven anthropomorphic figures discovered at Bankot were found systematically arranged one over the other and only some of them showed signs of chevron marking. This seems to suggest that the figures were manufactured locally and were subsequently carried to other places where the secondary work was performed (Kumar 2000).

Composition

Compositions of the material from select locations were obtained qualitatively in the EPMA. Quantitative EPMA could not be performed due to the non-availability of some metal and non-metal standards. Several analyses from the matrix locations showed that the major element constituting the material was Cu and the major impurities were C and Sb. Analyses from the second phase particles revealed that the major elements were Cu, Pb and S, while the minor elements were C and As. Therefore, it was confirmed that the material of construction of the anthropomorphic figure, that was studied, was almost pure Cu containing entrapped sulfides. Detailed chemical analyses of all the anthropomorphic figures have to be conducted to obtain further insights on the compositional differences, if any, between the figures.

In the copper hoard implements from Uttar Pradesh and Bihar, alloying of arsenic (up to 8%) has been reported (Agrawal *et al.* 1978; Nautiyal *et al.* 1981). As arsenic was not detected in the matrix of the anthropomorphic figure in the present study, it is reasonable to conclude that As alloying was not resorted to in case of the anthropomorphic figures because they merely served as cult objects or images.

The presence of C in the metal and in the entrapped sulfide inclusions, in the present case, indicates the possible use of charcoal for reducing the ore to metal. The presence of a significant amount of sulfide inclusions indicates that the material (Cu) was produced from the ore rather than being obtained in the native state. The presence of sulfide inclusions indicates the use of sulfide ores for producing the metal. The sulfide ore must have been rich in Cu and Pb, as indicated by the analysis of the entrapped sulfides in the copper matrix. As the sulfides could not be completely removed from the metal, this probably indicates absence of stirring of the melt and/or the relatively short time in which the metal was molten. Therefore, a small amount of these unreduced ores must have been invariably left behind. It is also possible to hypothesize that the ancient people did not know the art of refining Cu metal to a higher degree than the people of later period, thereby explaining the relatively high amount of second phase sulfide inclusions in the metal.

The presence of lead in ancient Cu is an impurity from the ore itself. It is supposed to be a persistent impurity. Its removal is favoured by acidic slags and, therefore, its absence in the metal may indicate the possible use of acidic slag (ex. fayalitic or silicate) during the extraction process. However, it must be noted that this is highly speculative and a detailed analysis of second phase particles in several other samples needs to be conducted to understand if fluxes (and the resulting slags) were used or not. As regards Sb, it partly volatilizes during smelting but not eliminated completely. The amount of Sb depends upon the atmosphere used for roasting. During roasting, they volatilize as Sb_2O_3 but some get converted to less volatile Sb_2O_5 and form antimonate with Cu. Usually, Sb is associated with As and, therefore, the identification of As in the second phase particles indicates that the original ore contained both As and Sb. However, as pointed out earlier, there has been no intentional alloying of As, unlike in the case of copper hoard implements (Agrawal *et al.* 1978; Nautiyal *et al.* 1981).

Copper Extraction Process

In general, the procedure adopted to extract copper from sulfide ore in medieval India was as follows. The ore was first roasted to remove the bulk of S. The roasted ore was smelted to remove the gangue material to produce Cu matte (copper iron sulfide). The copper matte was roasted and subsequently smelted with charcoal and flux, wherein S was oxidized to SO_2 and Fe to FeO, which was fluxed by silica (flux) to form the slag. This was strained off from the surface of the metal. The blister Cu, which was thus produced, was further refined. The copper-extraction furnace was generally built with refractory clay or was simply a deep hole in the ground with a clay rim at the sides and front (Shrivastava 1999). The insides were plastered with refractory clay. Clay tuyeres in the bottom of the furnace provided the forced draught. The furnaces were filled with lighted charcoal and raised to full heat by working of the bellows attached to the tuyeres. After furnace was lit and well heated, the material was gradually introduced alternately with charcoal.

Primitive Cu-making methodologies could certainly not have been the same (Tylecote 1962). Generally two methods are discussed with reference to copper extraction in ancient India (Tylecote 1962; Bharadwaj 1979). In one method, copper sulfide ore along with silica was powdered and mixed with dung and made into lumps. These were roasted in a hearth to convert them to oxide, in order to remove the bulk of S. The roasted ore was gradually introduced alternately with charcoal and flux (called *reet*, which was essentially slag from iron making furnace). The ore was also sprinkled from time to time. It has been mentioned that the relative proportions of materials roasted was 5 parts ore, 4 parts charcoal and 5 parts *reet* (Bharadwaj 1979). After this operation, the slag was removed from the top, leaving the heavier metal behind. When the heavier metal had solidified, it was taken out, pounded and kneaded with dung and made into balls. These balls were dried in the sun and then roasted with free access of air in shallow furnaces. The last process of refining consisted of treating the powder produced from these roasted balls in the same furnace and in precisely the same manner as the original ore, the result being a fluid mass of copper found at the bottom of the furnace which, on cooling, was removed. It was sometimes further refined before being utilized in useful product forms. It is unlikely that this method was utilized for extracting the copper that has been analyzed in the present study because iron making was not established in ancient India during the OCP period.

In the second method, sulfide ore was washed and smelted in furnace to separate gangue and CuS (Shrivastava 1999; Tylecote 1962). The sulfide ore did not undergo any change in this operation and was left as a cake in the bottom of the furnace. The slag was run off and the copper sulfide cake allowed to cool. These cooled cakes were broken, made into balls and roasted to oxide. The oxide was later smelted in the original furnace with charcoal and reduced to metallic state. In the present case of the Cu anthropomorphic figures, this would have been the likely process to extract the copper because of the presence of a significant amount of sulfides in the metallic matrix.

Source of Copper Ore

The possible source of ore for making the copper object is briefly discussed. The sulfide inclusions, being rich in Cu and Pb, indicate that the mineral source was a supplied ore. Copper metallurgy in ancient India has been reviewed extensively by Bharadwaj (1979). Copper ore was obtained from Rajasthan (Khetri belt) during the Harappan and Chalcolithic periods, while by the time of the copper hoard culture, newer areas of mining were exploited in Bihar (Singhbhum copper belt) (Bharadwaj 1979). The mining areas of Bihar appear to be the likely source for the material analyzed in the present study. Mineralogical examination of ores in the Singhbhum area indicated the availability of a wide variety of minerals (chalcopyrite, pyrrhotite, pyrite, pentlandite, magnetite, ilemenite, goethite, covelite, malachite, azurite, chrysocolla, cuprite, chalcocite) (Ball 1869). Evidence further suggests that Cu smelting started in Singhbhum area by the copper hoard period (Bharadwaj 1979). The exploitation of the rich ores of Singhbhum is evidenced by the discovery of copper hoards in the nearby districts of Manbhum, Karahari, Hazaribagh and Ranchi (Ray 1956). In fact, it has been rightly stated that copper metallurgy in India took rebirth in this area during the copper hoard period (Bharadwaj 1979; Agrawal 1971). A detailed spectroscopic examination of the specimen is required to understand the possible trace impurities and, based on this, to obtain deeper insights on the possible source of ore from which the Cu, used for making the figures, was extracted (Agrawal *et al.* 1978; Nautiyal *et al.* 1981).

Microhardness Measurements

Microhardness readings were obtained from several locations in the matrix and the results indicated a relatively soft matrix (hardness in the range of 65 to 80 kg/mm^2). The relationship of microhardness and grain size with the possible temperature range of working for the case of Cu has recently been addressed in detail (Ryndina and Ravich 2001). In the present case, grain sizes in the range of 30 to 40 mm and hardness in the range of 65 to 80 kg/mm^2 were obtained. These specifications are well within the range for cast structures (Ryndina and Ravich 2001). Earlier, based on microstructural analysis, several arguments were provided for the material being a cast structure. Microhardness measurements further confirmed that the discovered anthropomorphic figures were made by the casting process.

Conclusions

The material of construction of an OCP period (2650-800 B.C.) copper object has been characterized by optical and scanning electron microscopy and microhardness measurements. The major constituent of the green-coloured surface patina was cuprite, while the minor constituents were malachite and brochantite. The specimen exhibited an equiaxed structure with grain size in the range of 30 to 40 mm and hardness in the range of 65 to 80 kg/mm^2. Microstructural evidences (straight annealing twins, coring and rounded second phase particles) point to the anthropomorphic object being a cast structure. The composition of the metal was almost pure Cu, with minor impurities of C and Sb. The major elements identified in the second phase particles were Cu, Pb and S, which indicated that these particles were sulfides. The presence of these sulfides has been related to the probable Cu extraction process.

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Glass Beads in India: Lamp Winding and Moulding Techniques

Alok Kumar Kanungo

Dept. of Archaeology
Deccan College
Pune 411 006

Abstract

The production of glass was one of the most advanced techniques of the ancient world. Most of the early evidence for glass has been found in the form of beads. In India, glass beads are reported from more than 40 archaeological sites belonging almost solely to the early Iron Age period, with the exception of four beads from Chalcolithic Maski. There has been a lot of discussion on the numero uno position of Ancient Indian Beads (both stone and glass) in the Bead World at large. Interestingly, India enjoys the same position today. Owing to the breakdown of the monopoly of maritime trade, the location of bead manufacture, export and the via media of trade have changed.

Today, glass beads are produced in India at three different localities, using altogether different techniques, each leaving behind debitage unique to its individual manufacturing processes.

Archaeologically it is imperative to identify and record these production techniques of glass bead manufacture and to identify the various specific waste products; rather than merely speaking of beads and production centres on the sole basis of statistics.

There have been a number of studies on Indo-Pacific bead production, but few on other methods. One of the most important techniques of bead manufacture, used even today, is the 'Winding and Moulding' technique. Beads produced by this technique have been found in large numbers at various archaeological sites. This paper discusses the details of beads and bead waste produced by the winding and moulding technique and the specific criteria of production. It also uses results of a detailed ethnographic analysis at a single manufacturing centre and trading complex (the Banaras Beads Limited) to understand the production and dispersal mechanisms.

Glass beads from India

Glass has long been the most important material for bead manufacture. This is because of its beauty, durability, and versatility. First invented in the Middle East around 2500 B.C., the earliest sample of glass has been noticed at Tell Asmar in Mesopotamia from a stratum dated to c. 2700-2600 B.C. The Indians learned the technique of bead manufacture, probably independently, only around 1200 B.C. (Dubin 1987: 194; Francis 1992: 15; Kanungo: 2001a). There are nearly 100 ancient Indian sites, which have yielded evidence of glass, out of which about 50 are reported as having glass beads. So far the earliest evidence of glass beads in India is reported from Bhagwanpura in the Harappan-PGW overlap phase (Period I), c. 1400-1000 B.C. (Joshi 1993: 117). In the Ganga Valley the occurrence of glass beads is associated with the Painted Grey Ware (PGW) culture (c. 1000-600 B.C.). At Atranjikhera glass beads are reported from a period dated to 1200-600 B.C. (Gaur 1983. 218) and at Hastinapura they are found in Period II dated to c. 1100-800 B.C. (Lal 1954-55: 94). In the south, at Maski four beads are reported in the Chalcolithic level, dated to c. 800 B.C. (Thapar 1957: 107) and at Arikamedu from c. 300 B.C. (Wheeler 1946); in the Deccan, at Nevasa, they are found around 700 B.C. (Sankalia *et al.* 1960; Varshneya *et al.* 1988: 149). In the northwest, Taxila has revealed a number of glass beads, which speaks of Taxila as a trading centre in the 6th cent. B.C. (Marshall 1951).

Apart from the main centres i.e., Ahichchhatra and Kausambi in north India, Arikamedu and Karaikadu in south India; and Kolhapur and Nevasa in the Deccan, there are a number of other sites which have yielded evidence of glass bead manufacture. For example, there is evidence of half-finished beads from Tirukkampuliyur and Uraiyur in the Tiruchirapalli District of Tamil Nadu (Gururaja Rao 1970: 265). Early Historic Navdatoli in Madhya Pradesh has been regarded as a glass bead manufacturing centre because of the recovery of a number of glass slag and waste pieces (Deo 1971: 360-361). Khairadih in eastern Uttar Pradesh has yielded evidence of finished and unfinished varieties of red glass, slag pieces and cane from Period II (700-200 B.C.) and is reported to be a local glass bead industry (IAR 1981-82: 68). Also reported are the micro beads of blue glass from Period I (1100-700 B.C.) (IAR 1982-83: 93). The site of Kopia in Basti District of Uttar Pradesh, dated to about 5th cent. B.C., has yielded innumerable glass beads, thousands of glass fragments and lumps of unworked glass (Dikshit 1969: 39; Sen and Chaudhuri 1985: 64-65; Lal 1987: 45).

None of the excavation reports of Indian sites yielding glass beads has discussed the manufacturing technique. However, the morphology of ancient glass beads can speak of the probable method used to produce the same. This aspect of glass beads is very important as all the known traditional production techniques require different technological strategies which are unique and which leave distinct debitage. The discovery of glass tubes with some spherical and other designed glass beads at an archaeological site may not mean that it is a glass bead production centre. However, the discovery of micro-beads (Indo-Pacific) with perforated and unperforated glass tubes of different lengths along with other waste material probably indicates that it is an Indo-Pacific glass bead manufacturing centre (Francis 1990b; Stern 1991; Kanungo 2000). A highly developed and complex furnace is required for Indo-Pacific beads, whereas a small hearth-like furnace could be sufficient for scoop and furnace winding; and no furnace is required for lamp-winding.

Most of the beads found at archaeological sites in the Indian SuB.C.ontinent seem to be produced using either drawing, scooping or winding, and/ or moulding techniques. Ethnographically, there are three present-day major glass bead industries in India, which not only produce beads using traditional techniques, but also export them. These are at: 1) Papanaidupet (drawing method); 2) Purdalpur (furnace winding and manual pulling/ drawing method); and 3) Varanasi (lamp winding method). Barring, the complex drawing technique involved in Indo-Pacific bead manufacture other techniques have not been given due importance in the available literature (Francis 1990a, 1990b, 1991, 1994; Stern 1991; Kanungo 2000).

Winding and Moulding Technique

Glass is a "super-cooled liquid". The major ingredient in most glasses is silica, which needs a very high temperature to melt. It cools and hardens very fast. This leaves a very short span of time for the craftsmen to shape it. However, since ancient times, beads in glass have been designed/ shaped based on the artist's creative will. To give the shape, winding and moulding technique has been the most important technique. This is regarded as the oldest, simplest and most common method of bead making (Sleen 1973: 23; Francis 1992: 15; Basa 1993: 93).

Different methods of manufacturing beads have been discussed by Lamb (1965), Sleen (1973), Lugay (1974), Francis (1983), Basa (1993) and Kanungo (2001a). Right from the 2nd cent. B.C. onwards glass beads were made at different places throughout India, using indigenous techniques (Basa 1993). One of the most important and surviving glass bead production techniques in India is the winding technique. In this technique glass beads are produced by twisting the glass around a metal rod or wire. The beads produced by this method are commonly known as wound beads.

Of several ways to wind beads, two are common in India: one by lamp winding used at Varanasi and the second by furnace winding used at Purdalpur. However, all wound beads share one characteristic: the fabric of the glass, including any inclusions, is oriented around the perforation. In other words, striation marks can be seen parallel to the perforation in such beads. Very often different designed moulds are used to give various shapes to the bead. These techniques are discussed below.

Furnace winding: Glass is heated in a crucible in the furnace. An iron rod, called a mandrel, is dipped into the glass and while taking it out, with a quick twist, the glass bead is built up. While still hot it may be shaped with paddles and other tools or other glass may be added for decoration. Ethnographically, beads are produced following this technique in many parts of the world. They are China (many places). Middle East (Hebron, Gorece, Bida) Turkey, Egypt (Cairo), Uzbekistan, Afghanistan, India (Purdalpur), Pakistan (Hyderabad) and Nigeria (Francis 1992: 15).

Lamp winding: Glass is transformed into rods or sticks which are called canes. Workers melt them at a small heat source, traditionally a lamp (hence the name). The glass is then wound around a wire or a thin mandrel. While the glass is still hot, the bead may be shaped or given decoration with other colours of glass canes. These beads can be annealed in the lamp flame. Once cooled, beads are knocked down. Ethnographically, beads are produced following this technique at various places around the world. They are Italy (Venice), Czech Republic (Bihemia), Germany (New Gablonz), India (Varanasi), China (many places); Indonesia (Jombang), France, Germany and USA (Francis 1992: 15).

Distinguishing the beads produced by these two techniques is not easy, as far as ancient material is concerned. However, the internal features in wound beads can provide important clues. A black film of iron oxide from the mandrel is often left behind when a bead is furnace-wound. A powdery deposit may be left when a bead is lamp-wound because the operation requires a separator on the wire to remove the finished bead. A white powder (kaolin) is used at Banaras Beads Limited, Varanasi.

Moulded Beads: Wound beads can be pressed or spun in a half-mould to give them a special shape, but true moulding of beads was a development of the Bohemians (or Czechs) in northern Czechoslovakia (Francis 1992: 17). The original moulds were hand-held tong affairs into which a bit of hot glass from a cane was placed. In ancient Indian moulded glass beads, usually a very thin rim is seen. This is caused by two reasons. On joining the mould, the flow of excess glass creates a thin circumference around the piece or it is caused by differences created by differential cooling of the glass in the upper and lower face of the mould.

Banaras Beads Limited

In India, today Lamp winding technique is practised and mastered by the Banaras Beads Limited (BBL) of Varanasi. The industry was established in 1940 by the Late Shri Kanhaiya Lal Gupta after getting training under the able guidance of a Czech couple, Mrs. & Mr. Henrich, who had visited the Ceramic Engineering Dept. of Banaras Hindu University.

BBL produces an astonishing 50,000 varieties of glass beads which are exported worldwide. It exports 'lamp-wind' beads to over 50 countries, the more important of which are, Japan, China, Hong Kong, Thailand, Philippines, Lebanon, Syria, Jordan, Saudi Arabia, Australia, Senegal, Ivory Coast, Kenya, South Africa, countries of western Europe, USA, and Canada. However, 50% of the export is to the United States (Fig. 1). BBL is undoubtedly the number one glass bead producing and trading centre in the world.

BBL produces all its beads by lamp winding. For this, the material requirement is very small but craftsmanship is of a very high standard. Material requirements are: glass canes of different colour, blow-lamps, a tin to cover the lamps, a pair of bellows made of

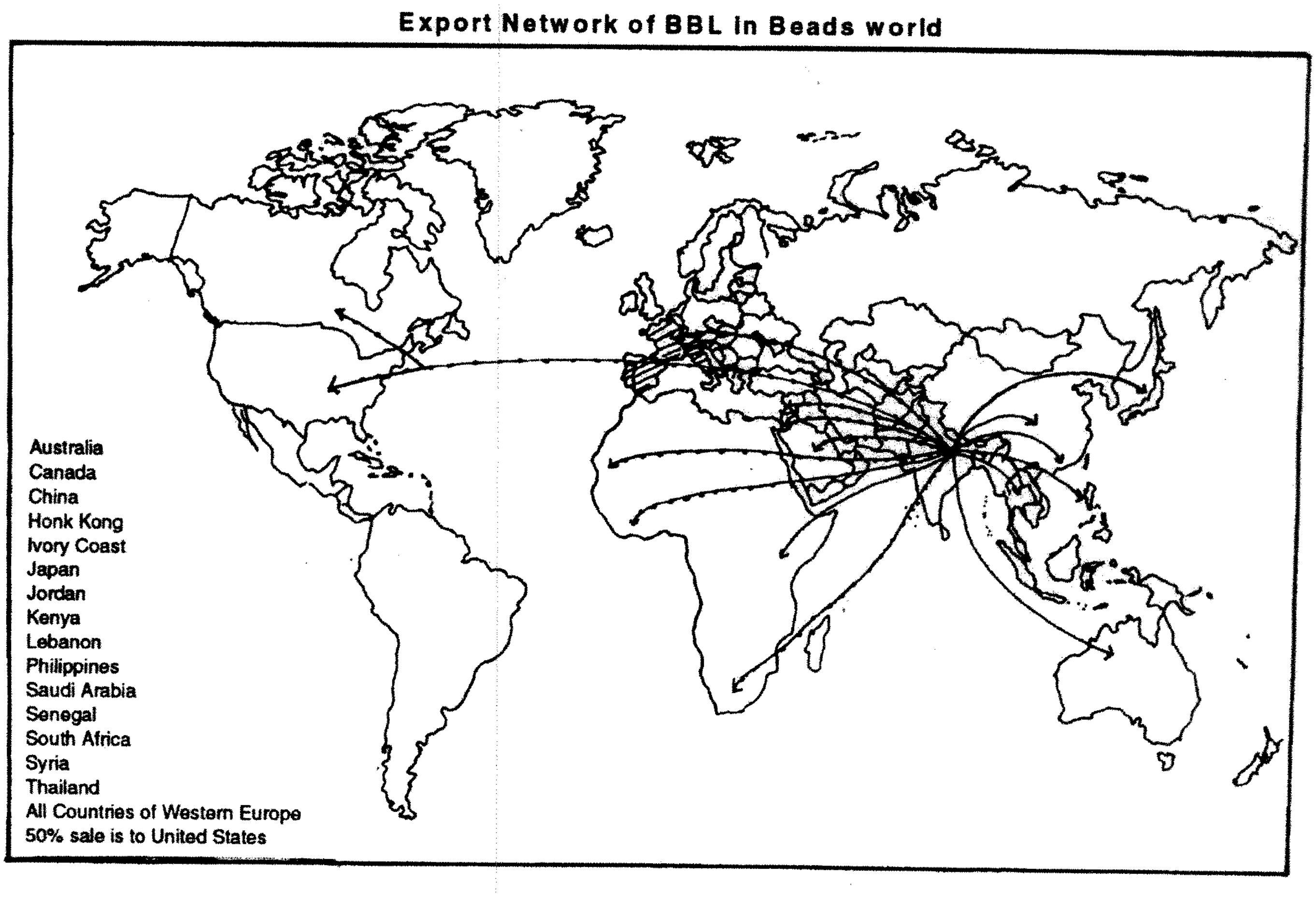

Fig. 1: Export network of BBL in world market

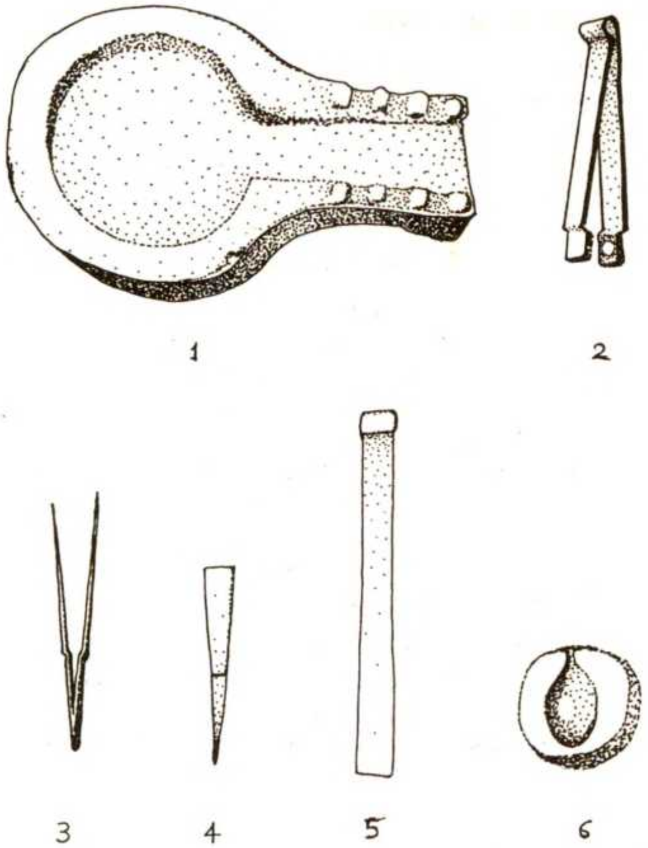

Fig. 2: Line drawings of the tools. 1: stone-stand with channel, 2: spring mould, 3: hand–held tong, 4: spatula, 5: a flat iron strip (*chipna*), 6: open half-mould

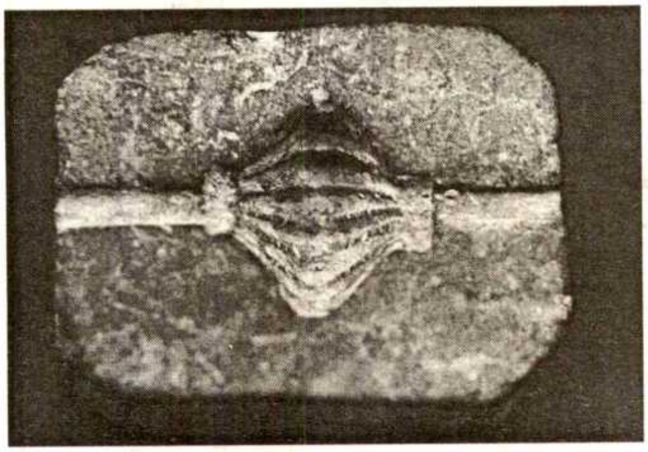

Fig. 3: A terracotta mould from Kausambi

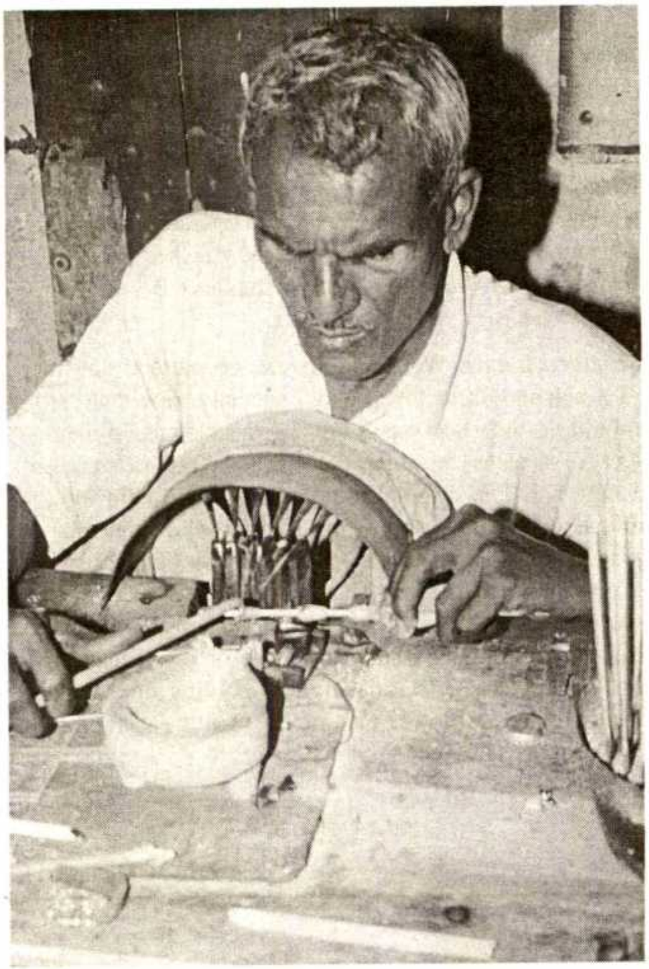

Fig. 4: A craftsman in his position

wooden planks and skin, mandrel or iron wire, an aluminium finger cap, China clay or kaolin, a stone-stand with channel (*mahadeva*), some hand-held tongs (*dohri chimti*), spring moulds (*chimta*), an open half-mould (*sacha*), a flat iron strip with raised edge of about 30 x 3 x 0.5 cm (*chipna*) and a chisel-shaped shaping spatula (*kahari*) (Fig. 2). Until as late as 1980, BBL was producing its own glass canes, but today they are imported from Firozabad. BBL has developed its own press moulds for its use. These moulds are like the moulds discussed earlier but instead of perforation on top they have figures with a perforation groove on both the half-moulds attached to a tong. The author in his exploration around the mound of Kausambi, Allahabad in 2001, found one such half mould. It is made of terracotta and designed to produce melon shaped beads (Fig. 3).

Craftsmen sit on a wooden stool keeping the requisite materials on a worktable on which blow-lamps are fixed and a pair of bellows beneath. Lamps are fixed on the chest height and the flame is directed forward to one point. Flame is topped with a tin cover for protecting vision and providing clarity of observation. There are from two to eight work places at the table, one of the craftsmen working on a work place keeps on treading the bellows. They provide a continuous air

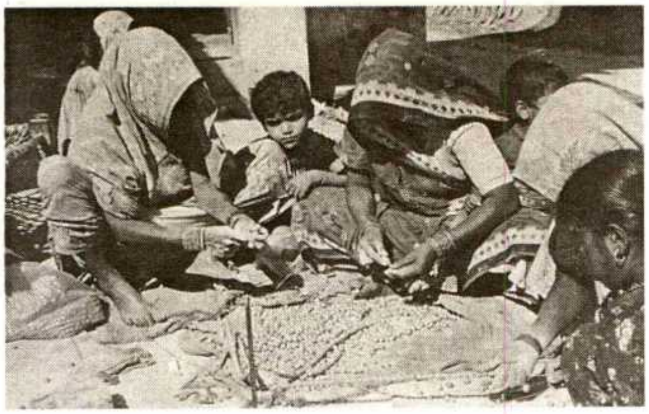

Fig. 5: Women cleaning the holes (After Kock and Sode n.d.)

supply, through three to seven air ducts to the lamps which makes it possible to achieve a temperature high enough for the glass to be melted and worked. Stone stand with a channel is kept below the flames. Then the craftsman putting a finger cap on his index finger picks up a mandrel, dips it in kaolin and starts winding the glass canes around it. The number of beads produced depends on the length of the mandrel, beads size and shape (Fig. 4). Both *Chipna* and *Kahari* are used for pressing and moulding glass, and, *dohri chimti* is used for both shaping and separating the beads while they are still in a semi-molten state on the mandrel. Before the finished beads are send to exporter or trader, the women of the village clean the China clay or kaolin out of the holes by pulling the beads back and forth on twisted metal wire (Fig. 5).

Most wound beads are produced with either one or a combination of the followings three techniques:

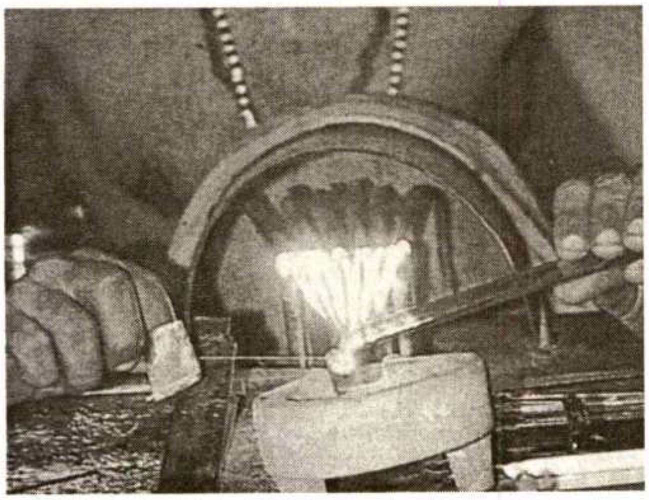

Fig. 6: A bead under preparation (Courtesy BBL)

1. Simple wound beads: They are produced by simply winding the different colour glass canes around the mandrel; and a master craftsman gives it any shape excluding that of figures (Fig. 6). For shapes like drop and bicone he uses a small open half mould of iron kept on the floor. The design is grooved in the iron (Fig. 2). Craftsmen twirl the mandrel with hot wound glass on this groove to get the shape.
2. Applique beads: For making different designs on beads the craftsman uses different coloured glass canes. Once the desired shape is given to a wound bead and it is still hot, the craftsman goes on designing beads with different coloured canes as per the requirement. This can also be done after cooling and reheating (imposing and over imposing).
3. Mould beads: After winding the glass and when it is still hot on the rod, the press tongue mould is used for giving various shapes and for designing figures.

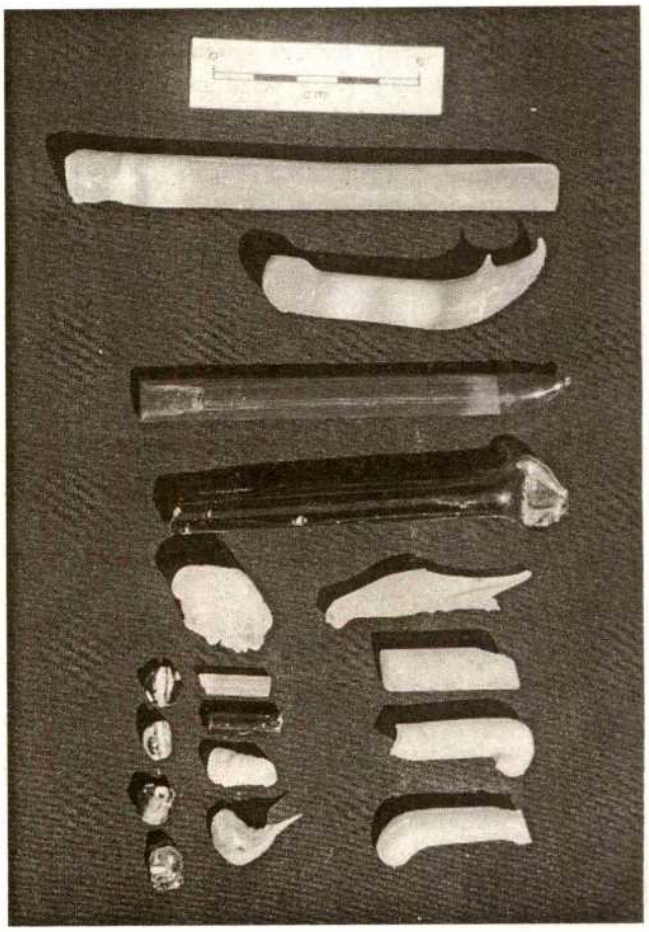

Fig. 7: Debitage of lamp beads production

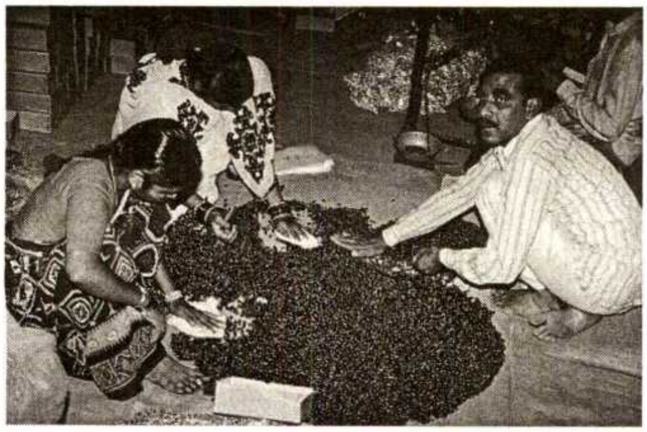

Fig. 8: Polishing of beads

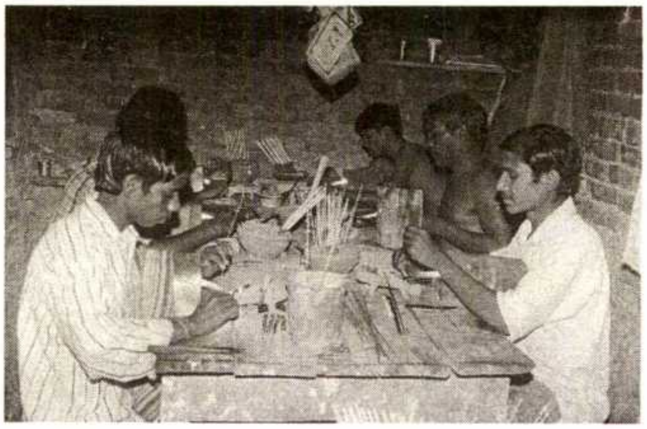

Fig. 10: Workshop at Adityanagar village

Debitage: Once the canes become too small to hold and get near the lamp, they are discarded. These pieces generally have one end with a sharp cut and another end with clogged molten glass. Sometime canes are broken during transportation or otherwise to too small shapes to use. These broken pieces would generally have sharp cuts on both ends. Here one has to consider that the craftsman who melts the canes knows very well that debitage may be recycled for making long canes again. This considerably reduces debitage. In the process of melting the canes to wind and design, small drops fall on the channeled stone stand and are accumulated nearby. Sometimes, on pressing the mould, extra glass comes out of the joint in the form of very irregular thin pieces (Fig. 7). Such pieces are also found near the hole cleaning and polishing/ rubbing area but in very small sizes.

Once the beads are produced they are polished/ rubbed on a gunny bag or coir mat (Fig. 8). After sorting, the beads are either packed for export or sent to different neighbouring villages for stringing (Fig. 9). In the latter case, they are sorted more efficiently as per their symmetry, and most of the unfinished, half finished and odd pieces are discarded, leading to the piling-up of such material in the village of stringing rather than in the production centre.

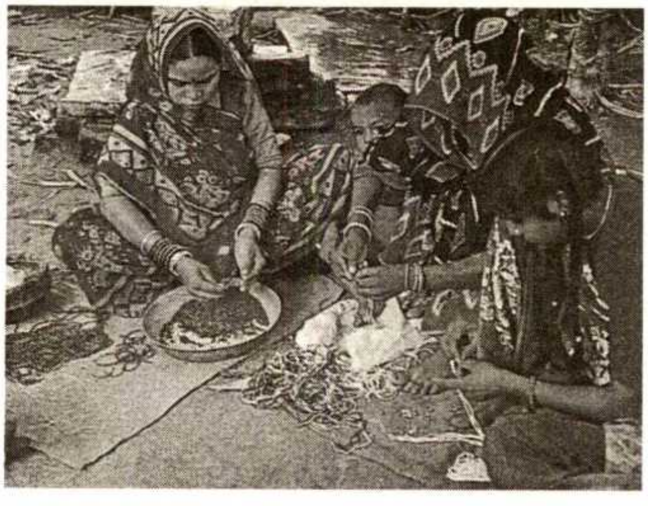

Fig. 9: Stringing of beads in a nearby village (Courtesy BBL)

Curiously enough in such a big production centre one finds only four to eight master craftsmen. The designer in the BBL either designs a new variety or clients come with their own designs. By a trial and error method clients' satisfaction is achieved. Once the final design is achieved, the master craftsmen of BBL teach the same to invited villagers. On requirement villagers stay there for a few days to learn and to practise. Once satisfied with their work, BBL gives them the order. Ultimately, the bulk of production takes place in the villages (Fig. 10). The industry's numero uno position is maintained, not at this centre alone but over the whole complex comprising 11 villages spread over the three districts of Uttar Pradesh, namely Varanasi, Mirzapur and Sonbhadra. Table 1 lists the BBL production centres in Uttar Pradesh (Fig. 11).

Since lamp beads are of different varieties, normally a master craftsman makes around 600 to 800 grams of plain beads or 100 to 400 grams of fancy beads per day. Learners only make plain beads; and achieve a target of 300 to 400 beads per day.

These beads have begun to be used by the urban people only in recent times but they have been used by primitive communities all over the world since ancient times. Two such user communities are the Juang of Orissa (Kanungo 2001) (Fig. 12) and the Ao Naga of Nagaland (Kanungo n.d.) (Fig. 13).

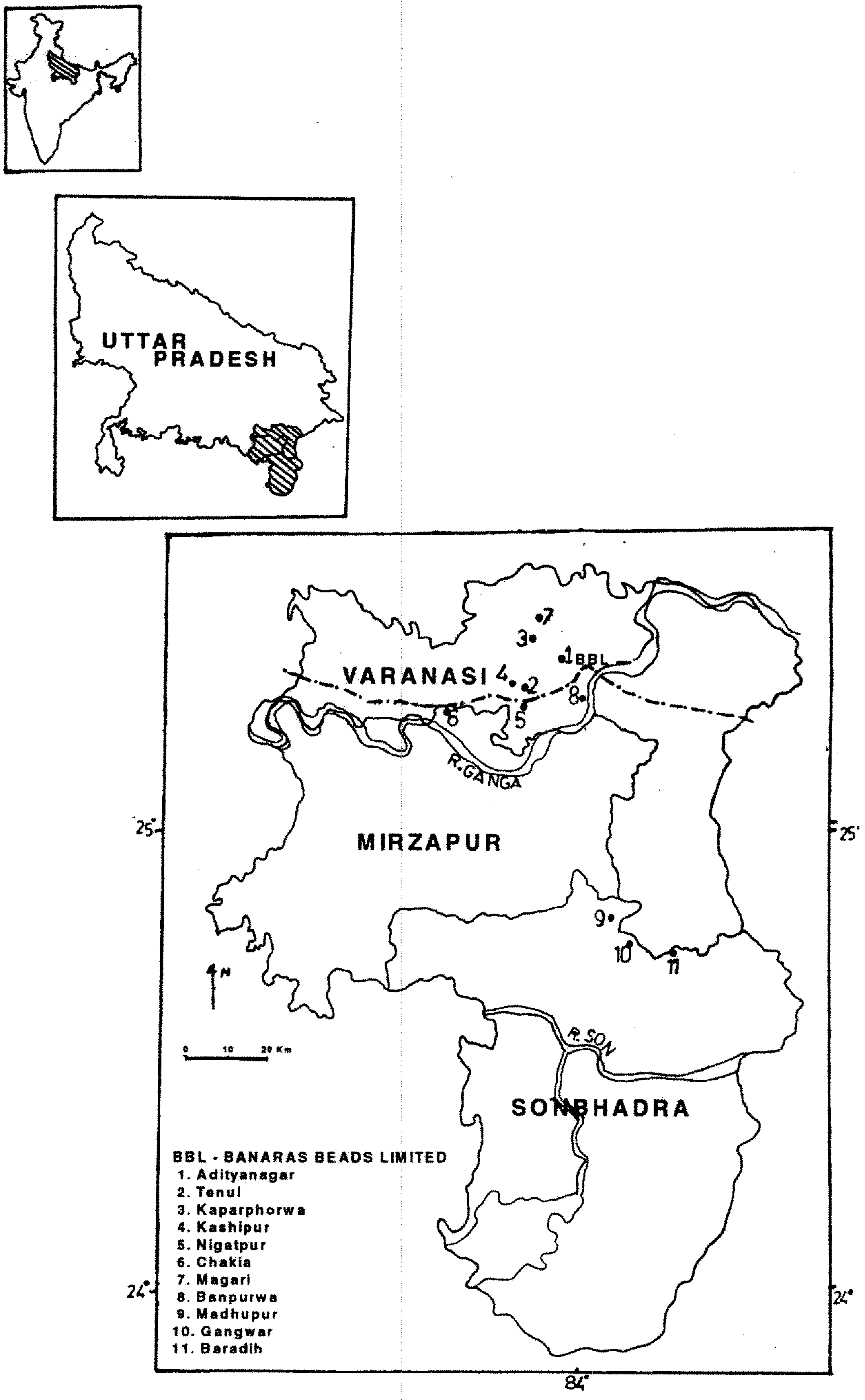

Fig. 11: Villages where the bead production takes place for BBL

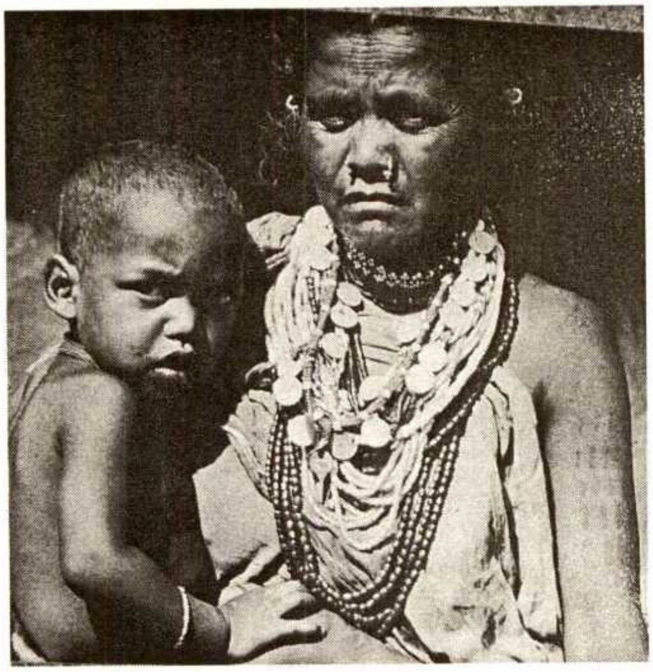

Fig. 12: A Juang woman wearing wound beads (Courtesy: Dr. Pradeep Mohanty)

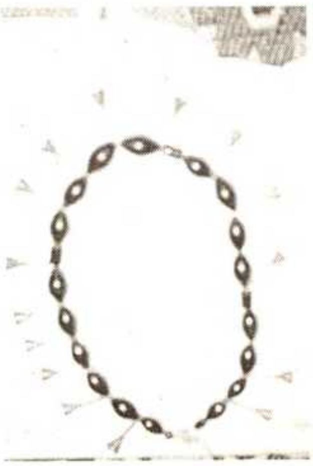

Fig. 13: An Ao Naga necklace

Table 1: List of BBL production centres

Sr. No.	Name of village	District	Distance from BBL (in km)
1.	Adityanagar	Varanasi	5
2.	Tenui	Varanasi	12
3.	Kaparphorwa	Varanasi	15
4.	Kashipur	Varanasi	16
5.	Nigatpur	Varanasi	20
6.	Magari	Varanasi	27
7.	Banpurwa	Varanasi	16
8.	Chakia	Mirzapur	25
9.	Madhupur	Sonbhadra	70
10.	Gangwar	Sonbhadra	73
11.	Baradih	Sonbhadra	78

Conclusion

BBL is not just a bead production centre, but a bead complex, where each village can be termed as a centre or sub-centre of bead production, despite lacking any direct contact or knowledge of BBL's export. As per this observation, it is likely that in ancient India also decentralization of bead production was followed, with control over trading activity being maintained in a geographically important place. This could be one of the reasons why such a large number of bead production centres in ancient India have been found. Rather than being "manufacturing centres" we may put the hypothesis discussed above and re-examine such sites.

As trading by sea was relatively more secure and land routes were limited, the coastal sites would have played a major role in trading activities like that of BBL. At present, the villages listed above are the actual production centres while BBL at Varanasi is a strategically located marketing centre, an important place for trading and a training centre. Thus BBL is likely to have less debitage than that observed in surrounding village centres. In contrast, in the villages the finished products will be less in number, as they are brought back to BBL for export. Trading takes place from BBL and not from any village. Thus the term 'trading contact' is applicable only to BBL, and not to the villages, though they get foreign material like canes and models from different placed via BBL.

There have been a number of claims for different sites to be glass producing centres. These are based on the discovery of beads in large quantity and/ or debitage. The claims are based on statistics rather than on scientific observation of bead making processes. No archaeological site has yet given evidence of a glass bead furnace and none should claim to be a glass bead production centre of all varieties of beads unless sufficient evidence is found.

Acknowledgements

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A Rare Discovery of Metal Objects from Agiabir, District Mirzapur, Uttar Pradesh

Purushottam Singh and Ashok Kumar Singh

Department of Ancient Indian History, Culture and Archaeology
Banaras Hindu University
Varanasi 221 005

Introduction

The ancient settlement of Agiabir (25° 13' 52" N; 82° 38' 41" E) was discovered in 1998-99 (Singh and Singh 1998-99) and it has been subjected to excavation for the past three field seasons (1999-2001) by the Banaras Hindu University under the direction of the authors. It is located on the left bank of the Ganga, near Katka railway station on the Varanasi-Allahabad section of the Northern Railway in district Mirzapur of Uttar Pradesh. The settlement extends over an area of more than a kilometre along the river and has been partly eroded by it. The main mound alone measures about 500 x 500 m. Excavation was carried out in the western part of the settlement (ABR 1) and in the eastern part of the main mound (ABR 2) during 1998-99 and an interim report has already been published (Singh and Singh 1999, 2000). The excavation yielded the following culture sequence:

Period I	:	Narhan Culture
Period II	:	Pre NBP with Iron
Period III	:	NBP
Period IV	:	Sunga-Kushana
Period V	:	Gupta and post Gupta

In the second and third seasons excavation was conducted in a 20 x 20 m area on the southern side of the main mound which resulted in the discovery of a large house complex of burnt bricks. It comprised 11 rooms of various sizes in five building levels (Singh and Singh 2001: 157-159).

During the 2000-2001 excavation, the most important discovery of the NBP period was a cache of copper and iron objects found in a room. This cache was buried in layer (12) and was resting on the top of layer (13) which represents a rammed clay floor (Fig. 1). The copper objects *in situ* include three vases (*handas*) with flaring rim and body diameters of 41, 37.6 and 35 cm, respectively, two carinated *handis* with featureless rims and body diameters of 31 and 30.8 cm respectively, one lid-like object, one *lota* shaped vessel with diameter at the mouth of 27.6 cm, one bowl with incurved rim and diameter at the mouth of 15.1 cm, one miniature bowl with featureless rim and diameter at the mouth of 11 cm, and a mirror. All these objects except the *lota* were placed upside down at the depth of 6.60 m below datum. The iron objects include two swords with lengths of 69.5 and 64.5 cm respectively, and a lamp stand. A bowl with four raised dots at the rim is fitted on its top and a circular shallow plate is fitted just below. Such a cache of vessels and implements has not been so far reported from any other NBP site. The detailed account of the objects is given in Table 1.

Cultural Context

The cache was found buried in layer (12) and was resting on the top of layer (13) which represents a rammed clay floor. The contents of these two layers comprise coarse grey ware and a coarser variety of NBP. The frequency of Black- slipped ware is less. The bowls and dishes of Black -slipped and Grey ware have either a pointed knob in the centre or concentric circles with a raised knob in the centre. These pottery types are also recorded from Period IC at Rajghat (Narain and Roy 1977, Fig. 10, Nos.2-5). Besides, certain new types of vessels occur in Red ware. These comprise pear-shaped vase with several variants (Ahichhatra 10A), vases and miniature vessels, carinated *handi* with featureless rim, bowls with flat base and dishes with sagger base. The antiquities recovered from these layers are antimony rods and beads of copper, together with iron objects, bone points, beads of semi- precious stones, terracotta balls and skin rubbers. Two silos were also exposed in the vicinity of this cache in the northern and southeastern sides of the house. A uniform burning of 20 cm at the base of Layer (13) was noticed throughout the excavated area of 5.15 x 2.50 m. As the excavation was confined to a small area, it is difficult to determine whether this burning is deliberate or accidental. A similar burning activity of the same period was noticed in the corresponding levels at Narhan (Singh 1994: 14) and Jhusi (personal information from Prof. V.D. Misra).

Copper cooking vessels identical in shape with these of the present site have been recovered from the Saka-Parthian city of Sirkap and have been dated to the first century A.D. (Marshall 1951: 258, Pl. 174, Nos. 257-258). A copper vessel of similar type was reported from

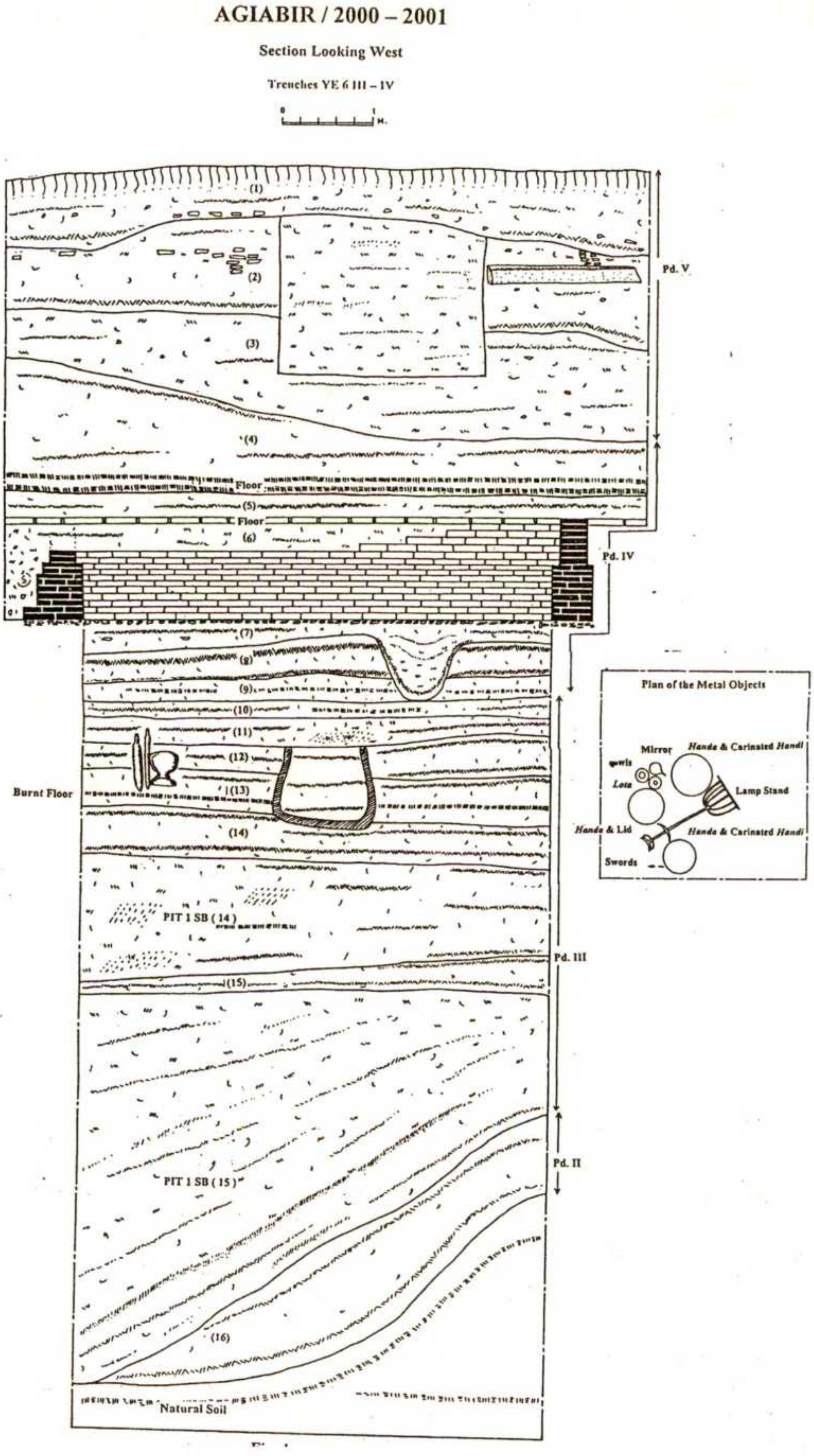

Fig. 1: Section of the trench YE6 III and IV and its stratigraphic sequence

Table 1: Metal objects found at Agiabir (2000-2001, Trench-YE6 III , Stratum 13 Depth 6.60 m below datum)

Figure reference	**Condition, Material and Shape**	**Description**	**Measurements (cm)**
Fig. 2	Complete cooking vessel (*handa*) of copper	with a flaring, featureless rim, constricted neck, carinated shoulder, expanding sides and sagger base. The bottom of the pot is rough and burnt. The pot is made in two pieces which are jointed at the shoulder.	Diameter of the mouth 24.70 Diameter of the body: 41.00 Thickness of the rim: 0.50 Height: 39.60
Fig. 3	Complete cooking vessel (*handa*) of copper	with a flaring, featureless rim, constricted neck, carinated shoulder, slightly expanding sides and sagger base. The bottom of the pot is blackish and burnt.	Diameter of the mouth: 20.20 Diameter of the body: 37.60 Thickness of the rim: 0.53 Height: 36.60
Fig. 4	Complete vase (*handa*) of copper	with a flaring, featureless rim, constricted neck, carinated shoulder, slightly expanding sides and sagger base. The bottom of the pot is blackish and burnt.	Diameter of the mouth: 21.00 Diameter of the body: 35.00 Thickness of the rim: 0.52 Height: 34.00
Fig. 5 (1)	Complete miniature copper bowl	with internally bevelled rim and convex sides	Diameter of the mouth: 11.00 Thickness of the rim: 0.71 Height: 5.40
Fig. 5 (2)	Complete copper bowl	with a featureless rim, uniformly thin sides and a footed base	Diameter of the mouth: 15.10 Thickness of the rim: 0.40 Height: 5.20
Fig. 5 (3)	Complete *Lota*	with outturned thick rim, high concave neck, globular body and flat base	Diameter of the mouth: 10.50 Diameter of the body: 15.50 Thickness of the rim: 0.58 Height: 17.20
Fig. 5 (4)	Complete rimless *handa* of copper	carinated with featureless rim which is pressed inside the pot	Diameter of the mouth: 19.00 Diameter of the body: 30.80 Thickness of the rim: 0.28 Height: 9.09
Fig. 5 (5)	Complete carinated *handa* of copper	with a featureless rim and an almost round base. A similar copper *hindi* is reported from Narhan, District Gorakhpur from the earliest phase of NBP (Singh 1994: Pl. XX, C).	Diameter of the mouth: 19.00 Diameter of the body: 31.00 Thickness of the rim: 0.30 Height: 9.00
Fig. 5 (6)	Copper lid	with short incurved rim, flattened from the top and a slightly concave base. It has a pointed solid knob on the inner side of the base with one concentric raised band around it. Similar concentric raised bands are present in the bowls of Rajghat in Period IC (Narain and Roy 1977: Fig. 10, Nos. 2-5).	Diameter of the mouth: 27.60 Diameter of the body: 33.60 Thickness of the rim: 0.57 Height: 3.20

Table 1: *continued...*

Figure reference	Condition, Material and Shape	Description	Measurements (cm)
Fig. 5 (7)	Complete copper mirror	Circular in outline, and with a thick rim and pointed handle. Its face is smooth and slightly convex. The back is plain. Two copper mirrors are reported from Mason Dih, District Ghazipur, Uttar Pradesh about 60 km. northeast of Agiabir from the NBPW levels and on Gupta levels (*IAR* 1964 -65: 42-43 ; Ghosh 1989, I: 348), 42-43; Ghosh 1989, I: 348).	Diameter of the mirror: 14.00 Thickness of the rim: 1.00 Length (including the tang): 20.00 Length of the handle: 6.00
Fig. 6	Complete double-edged iron sword	with a thin blade, pointed tip, solid tang of circular cross-section. The sword is highly corroded.	Length of the blade: 69.50 Width of the blade: 5.30 Length of the tang:10.00
Fig. 6	Double-edged iron sword	with a thin blade, edges tapering to a pointed tip, and solid tang of circular cross-section It is badly corroded.	Length of the blade: 64.50 Width of the blade: 8.00 Length of the tang: 10.00
Fig. 7	Lamp Stand	—	Length: 1070 Thickness of the Rod: 4.00 Diameter of the base: 43.00 Diameter of the bowl: 14.00 (fitted on the top of the lamp stand) Diameter of the shallow Plate: 24.00 (fitted below the above bowl)

Chandraketugarh (District 24 Parganas, West Bengal) from the surface (Ghosh 1989: 95-96) and another was found at Mahasthangarh (Bangladesh) from the Kushana levels and an identical example has been reported from the NBP level at Narhan (Singh 1994, Pl. XXC).

Circular mirrors polished on one side and plain or decorated on the other side, have been found in limited number at several sites. Two copper mirrors with along tang are reported from Harappa (Vats 1940: 391). The diameters of these mirrors are 16.00 cm and 17.50 cm, respectively. The finest examples of copper mirrors (nineteen in number) come from Taxila, where they were found in the Saka-Parthian levels at Sirkap and are datable to the first century B.C.-A.D. (Marshall, 1951: 215, 584 - 85, Pl. 182, Nos. 208-211).They are circular in shape and vary between 5.55 and 16.5 cm in diameter. Three specimens were found in the Kundangar Hoard at Brahmapuri (District Kolhapur, maharashtra) placed in a large metal pot buried in a room of the Satavahana period (first-third centuries A.D.) (Khandalavala 1960: 27-95) amd two copper mirrors are reported from Mason Dih (District Ghazipur, UP), one in the NBP levels and the other in the Gupta levels (*IAR* 1964-65: 42-43; Ghosh 1989, I: 348).

As regards the swords, identical iron swords found at Taxila vary from 52 to 85 cm in length and belong to first century A.D. Strabo and Arrian state that the Indian soldiers carried broad swords three cubits in length in the fourth century B.C. (Marshall 1951, II 542-43, Pl. 164). Iron lamp stands are not reported from any site in India. The two lamp stands (*candelabra*) recovered from Taxila have been dated to the first century A.D. (Marshall 1951, II: 542). These consist of a plain vertical rod with a tripod base and leaf like terminal or ring at the top. The height of these lamps varies from 52 cm to one metre (Marshall 1951: 542, Pl. 163, Nos. 33-35). From the above description it is clear that cooking vessels, swords and lamp stands occurring at other sites belong to a much later date than those from Agiabir.

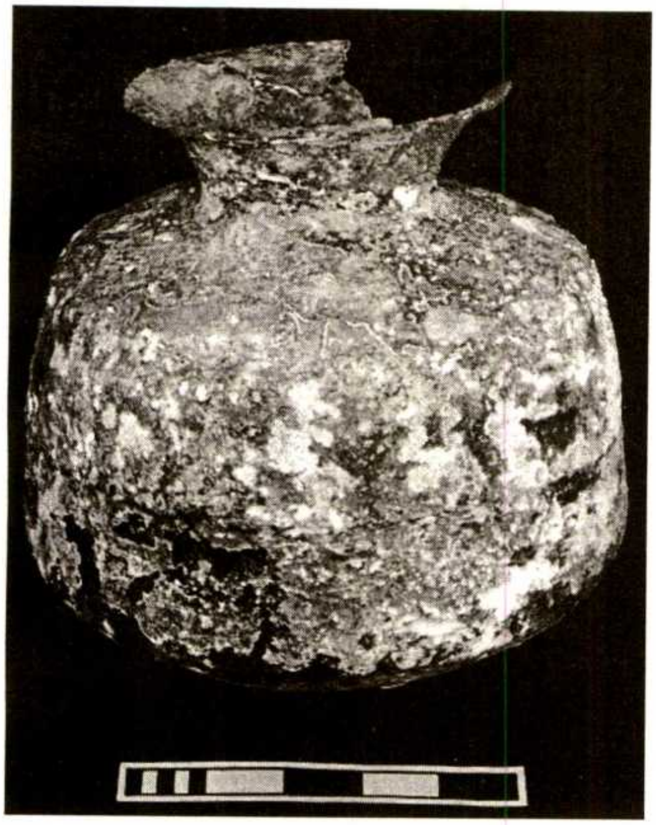

Fig. 2: Cooking vessel Vase of copper, Period III

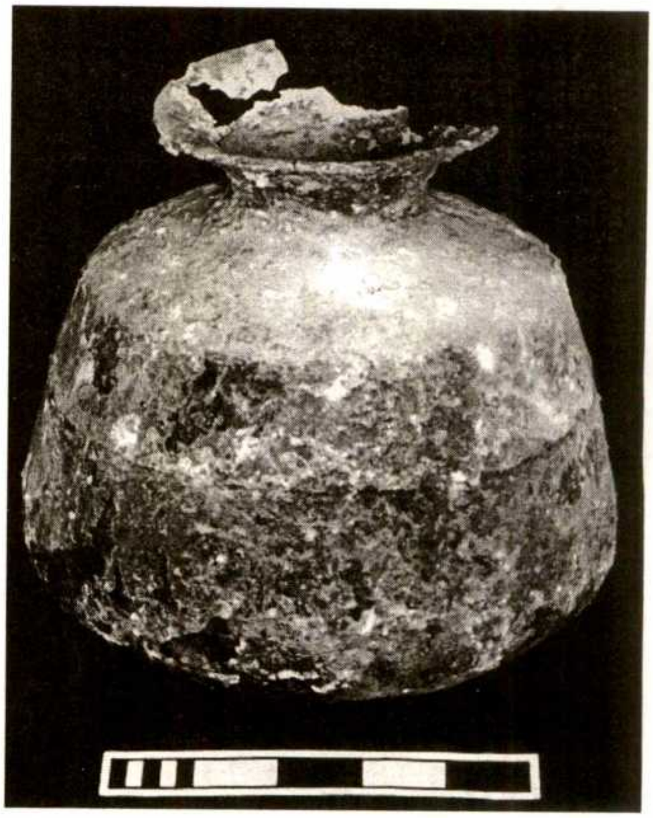

Fig. 4: Vase of copper, Period III

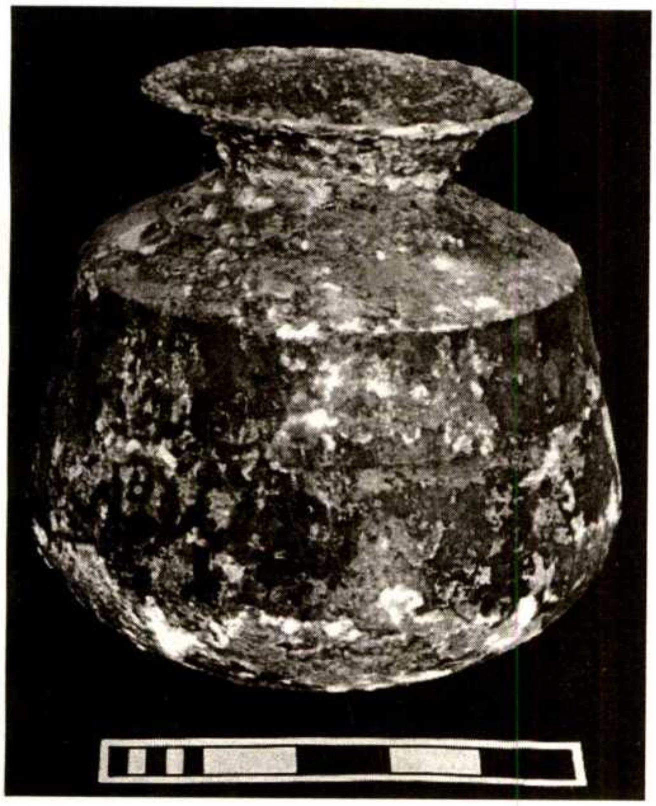

Fig. 3: Cooking vessel (*handi*) of copper, Period III

Thus the discovery of the metal objects from Agiabir is unique for more than one reason. It is noteworthy that no other NBP site in India has yielded metal objects of these shapes comparable to Agiabir in quantity or quality. Besides their large number, the metal objects of Agiabir are also significant for the variety. As mentioned above, the iron lamp stands are not found from any other site in the Ganga valley. The lamp stand found at Taxila is of later date. The prosperity and flourishing trade and economy of the NBP culture of the Ganga plain is well reflected by the recovery of these metal objects from Agiabir. Needless to say that it reveals a new facet of the middle phase of the NBP period (3rd-4th centuries B.C.) and it throws fresh light on the trade of this area with other parts of the country as well as the socio- economic conditions of this period. These findings are reflective of economic prosperity of this period of Indian history. The richness of objects shows that if Agiabir is horizontally excavated in future, it may yield more metal objects.

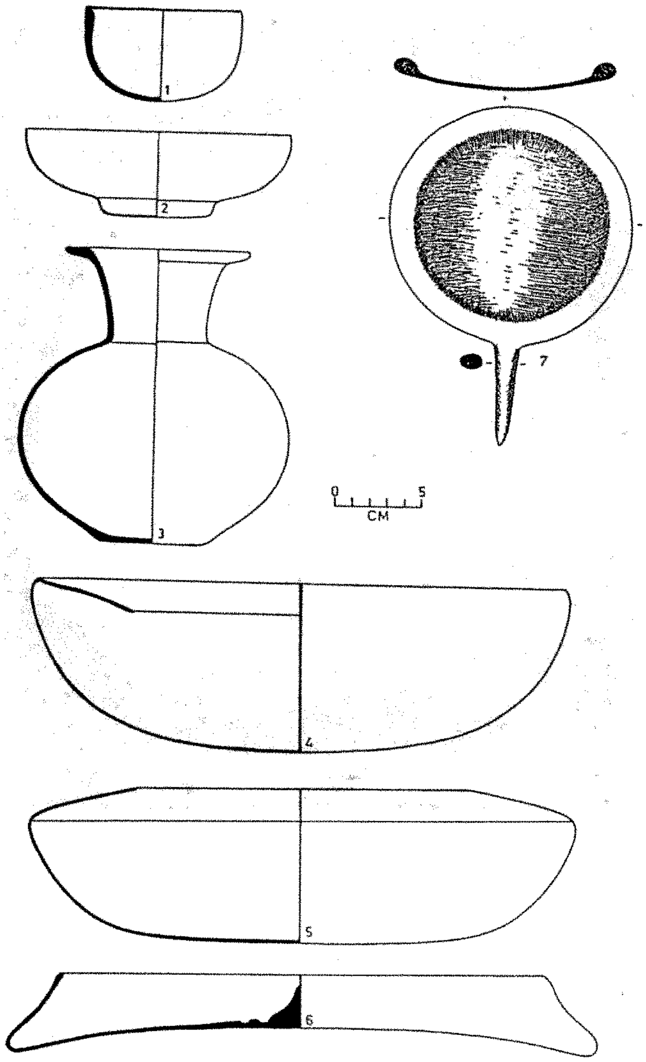

Fig. 5: Copper objects, Period III. **1**: Miniature bowl of copper , Period III. **2**: Bowl of copper, Period III. **3**: *Loti* shaped vessel of copper, Period III. **4**: Carinated *hindii* of Copper, Period III. **5**: Carinated *hindi* of Copper, Period III. **6**: Lid of Copper, Period III. **7**: Copper mirror, Period III.

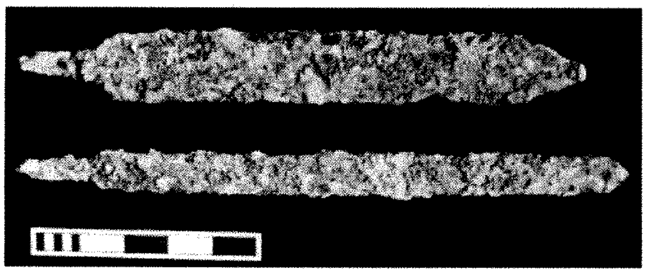

Fig. 6: Swords of iron with handle, Period III

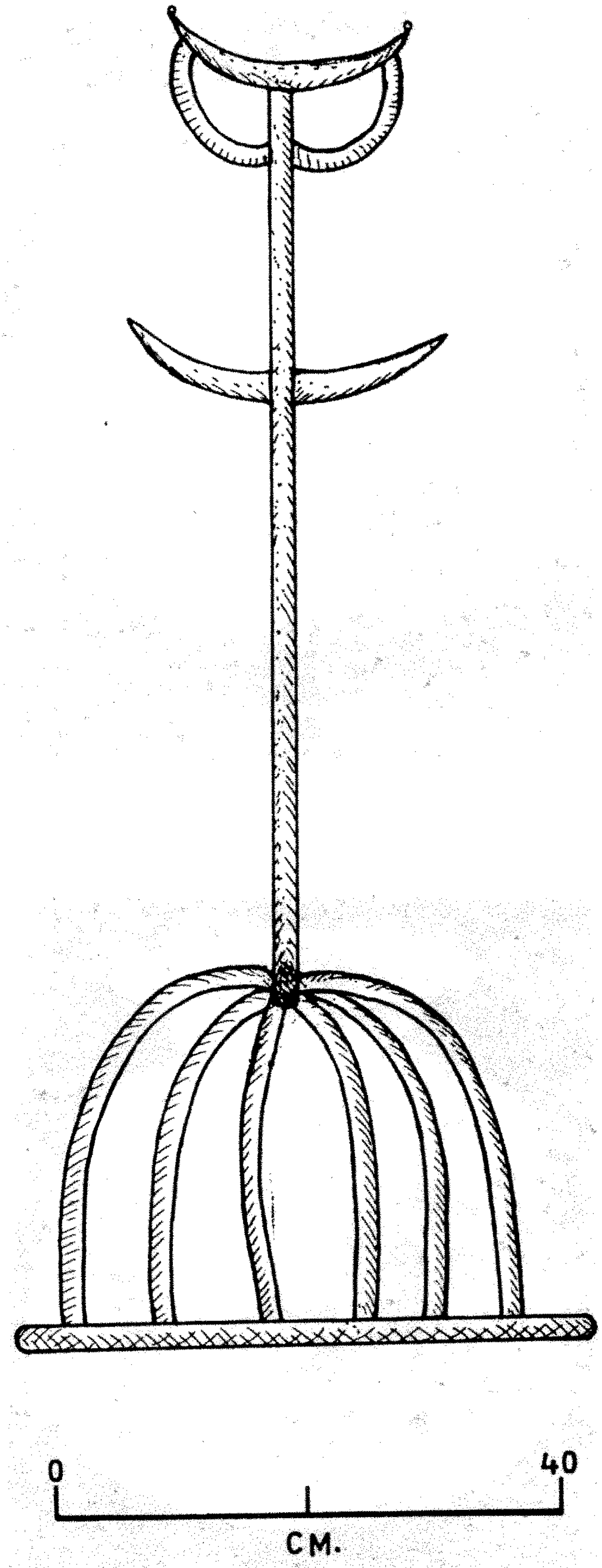

Fig. 7: Lamp stand of iron, Period III

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Addenda to The Copper Hoards of the Indian Subcontinent: Preliminaries for an Interpretation*

Paul Yule

Orissa Research Project 2 (DFG)
Chair for Asian History
University of Kiel
Leibnizstr.8
D-24118 Kiel, Germany

The above-cited study on the copper hoards and the archaeometallurgy of the Subcontinent went to press in 1987, is dated 1989, and appeared in 1992 abroad. It builds on my book of 1985 regarding this same thematic area. Thus, I completed the catalogue of finds and of sites (particularly those of Orissa), mapped the findspots, including those of the culturally related Ochre Coloured Pottery, and those of copper ore deposits, listed for the first time the spectroscopic analyses of large numbers of hoard artefacts, and provided new interpretative models to explain the importance and origin of the hoards. The following notes are intended to complement my study and less to justify it. While at first glance the foregoing publication seems largely unknown in India, careful scrutiny reveals several studies which it spawned (for example cf. K. Kumar 1992 and C. Gupta 1997). If one raises the question, whether the role of the hoards has become unfashionable as a topic and therefore is unrepresentatively treated in the literature, the answer is clearly "no".

Two recent relevant publications subsequent to my study of 1989/1992 command our attention — first V. Tripathi's edited monograph on the *Archaeometallurgy in India* of 1998 deals aspects of archaeometallurgy and related studies too numerous to mention. D.K. Chakrabarti and N. Lahiri's *Copper and its Alloy in Ancient India* of 1996 summarizes and comments critically on the archaeometallurgy of India and contains current data tables of quantitative analyses of metal artefacts. In reply to the latter authors, my typology of 1985 and 1992 is by no means too detailed. This instrument provides a more precise definition of the artefactual composition for the different regions. Needless to say, an artefactual type (especially simple ones) can occur in more than one geographical area. Important is these authors' recognition of the close relationship of the hoard finds from South Haryana/North Rajasthan with artefacts of the so-called Ganeshwar culture (p. 83) which are related morphologically. Excavated in the early 1980s, the finds from Ganeshwar and nearby associated sites unfortunately have never been properly documented and the appearance of the constituent finds is still hardly known. The four regional/typological groupings of hoard finds (1 North Rajasthan/South Haryana, 2 Doab, 3 Chota Nagpur, 4 Madhya Pradesh) remain viable (M. Lal 1983: 65-77). Worthy of discussion and research is Chakrabarti and Lahiri's possible connection (p. 86) of the eastern hoards of the iron age Asura horizon for chronological purposes. A further study attempts to integrate the eastern hoards into a more general archaeological cultural matrix (D.K. Chakrabarti 1993, 39, 60, 81, 112, 137, 172, 212) so that they are not mere antiquarian curiosities. With this welcome development the hoards do not comprise an obsolete topic in India, giving way to new sites/cultures made fashionable owing to their better documentation and later date of discovery.

Relatively recent studies on the hoards include those of S.P. Gupta (1989: 91-93) and M.K. Dhavalikar (1997: 251-260). The first seems to have been in press for several years before appearing, out of range of mid 1980s sources. The second renowned author is unaware of recent work and relies mainly on that of B.B. Lal of 1951. Dhavalikar's dating of 1700-1400 B.C. (p. 259) for the hoards is simply a rough estimate. Both ends of the chronology are particularly problematic (see below).

Following the issuing of the subject of this essay, other aspects of the metal work of prehistoric India appeared in publications and require at least brief mention. These include several additions to the catalogue of finds including two striking new morphological types/variants. One is a humped bull in the style of the eastern hoards (that is, a zoomorph). The other is a variant type 1 anthropomorph (Yule 1985: 51-52 for this definition) said to come from Madarpur, which differs from the known ones in that one of the arms turns upward and the other downward.

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* This note is a suppliment to the author's book length entitled, "The Copper Hoards of the Indian Subcontinent; Preliminaries from Interpretation" with Appendix I & II by Andrean Hauptmann and Michael J. Hughes, published in Jahrbuch De Romisch-Germanischer Zentralmuseums Mainz, 36, Jahrgan 1989 (1992). It brings upto date the information about the copper hoards.

A further development dealing with the hoards is their continued robbing, illegal export, and appearance on local and international art markets.

The published AAS analyses of the material reveal a different chemical composition for the different hoards corresponding with the composition of their ores. Thus the finds from the Ghangaria hoard and from the eastern hoards normally contain less arsenic than the others (usually beneath the measuring threshold). The data do not support D.P. Agrawal's belief about the arsenical alloying of hoard objects (D.P. Agrawal 2000: 226), owing to the insignificant amount of the arsenic, which in such concentration would have no practical effect on the hardness. The arsenic occurs naturally in the ore. Nor does the writer concur with him, in light of the location and date of the findspots of OCP (Ochre Coloured Pottery), that, "no definite archaeological assemblage has been associated..." [with the hoards] (p. 226).

Whether or not it is correct to designate the copper hoards as a "culture", as some do, is a moot question. Given the above-mentioned connection between the doab hoards and the OCP, perhaps for this group an option would be the designation "doab hoard-OCP culture". This would put the definition on a broader basis than simply by virtue of a single industry. But this matter is more complex for the hoards from South Haryana-North Rajasthan, from eastern India, not to forget those from Madhya Pradesh, since associated finds there are of disputed and/or of uncertain origin, are few, or are missing which would complement the picture of these artefactual assemblages.

D.P. Sharma's and B. Singh's reanimation of the broken anthropomorph from Lothal as an "axe" is only possible if one ignores the published cross section (Yule no. 22), size, surface decoration, and other aspects of the object (Sharma 1998: 293; Singh 1995: 171, Fig. 31). This fragment is important since it raises the date of the hoards by means of its reported context to the beginning of the 2nd millenium B.C. Singh further confuses matters by attributing a hoard anthropomorph to Mahenjo Daro (Singh 1995: 164, Fig. 24.4).

The idea that the anthropomorphs were designed to be thrown is not new. This was suggested for the artefact itself (D.P. Agrawal 1982:200), perhaps with the help of a handle (T.K. Das Gupta 1975: 75-81), or more recently by means of a cord (H. Falk 1994: 196). Another notion of this ilk is that the "bar celts" and/or "bar-celt ingots" are bludgeons. To such suggestions, the old adage comes to mind, "form follows function". One can use any stout object to strike or throw, but ancients and moderns alike usually optimize the form to suit a special use, for example to overtrump particular kinds of weapons used by opponents. While the author can only hypothesize or propose models about the ergological function of the different hoards or their constituent artefactual types, most types do not appear to be functional tools because, as previously stated, they are unsuitable for a variety of reasons (interpretation confirmed partially by M.P. Joshi 1995-96: 26-27).

D.K. Chakrabarti suggests that for whatever reason, hoards have come to light in the immediate vicinity of important routes (personal communication). This is true, for example of the Ghangaria hoard, as noted by D.H. Gordon. The problem of manufacture remains obscure owing to dearth of sources. Clearly the hoards were manufactured by settled people and not by hunter-gatherers.

Lastly, in my main studies on the hoards of 1985 and 1992 I avoided the issue of alleged Indo-Aryan authorship, in an attempt to deconstruct or simply ignore it. This theory arose at a time when only the doab hoards, urban, as well as post-urban Harappa Cultures in northern India were known. It is based on the assumption of the date of the vedas and that of the hoards *during* the post-urban Harappa Culture. But if the earliest Veda, the Rigveda, is at home in Punjab (G. Erdosy 1995: 85), then the hoards hardly reflect early Indo-Aryan origins there in terms of their geographical distribution since they occur in different areas and not first in Punjab/Haryana. Nor does the unclear chronology of the hoards establish this attribution, despite unfounded allusion to the "late phase of the Copper Hoard Culture" (Parpola 1995: 362). Linking the hoards with linguistic or radially distributed tribal groups has no anchoring points — it is just a theory coinciding with a time slot and one with little more than this to recommend it. The fewness and poor quality of the archaeological contexts containing hoards and the resultant chronological aporie guarantees impunity for the launch of virtually any theory as to origin. It is perhaps for this reason that in a recent essay regarding the end of Harappan urbanism that one author sovereignly ignores the existence of the hoards in second millenium North India (Allchin 1995: 26-40).

The provenances of the following addenda to the corpus best can be described as "said to come from..." And can neither be verified from the finders nor otherwise documented.

Eastern Chota Nagpur and Periphery

Axe-ingots II (x6), zoomorphic "ingot" in the shape of a zebu.- P.S. Khajraveri, Dist. Midnapur, W.B. (c. 22° 26'

N; c. 87° 20' E). — found by local villages while digging for *murum*. In all, 7 artefacts were acquired by the Calcutta Circle of the ASI.- Anon. 1990-91 [1995], pl. 43a-d; 44a-c, p. 92.

Ganges Yamuna Doab and Periphery

Anthropomorph I. — Madarpur, Dist. Moradabad, U.P. (c. 28° 50' N; c. 78° 47' E). — On exhibition in the National Museum, Delhi.

Anthropomorph I, Harpoon II. — "North India". — P. Yule 1998: 23-31.

Anthropomorph I?. — "Basel". — M.P. Joshi 1995-96: 25.

Anthropomorphs I (x2). — Nurpur, Dist. Bijnor, U.P. (29° 09' N; 78° 25' E) — M. Sharma and D.P. Sharma 1998, pl. 65 and 66, p. 88 citing D.P. Sharma 1991: 8, pl. 66 in the 1998 article is incorrectly identified as from Dist. Manbhum, Bi. (= Yule no. 539).

Anthropomorph of uncertain type. — Haldwani, Dist. Nainital, U.P. (29° 21' N; 79° 51' E) — Amar Ujala, 8 May 1986: 3; D.P. Agrawal 2000: 107.

Anthropomorph of uncertain type. — Gangetic valley. — D.P. Agrawal 2000: 108. Misquoting J.P. Joshi 1990: 14.

"Anthropomorph" of uncertain type. — Chokhopani, Dist. Mustang, Nepal (c. 28° 55' N; c. 83° 55' E). — M.P. Joshi 1995-96: 25.

Axes. — Midnapur, Dist. Shahajahanpur, U.P. (27° 52' N; 79° 41' E). — Hoard of 9 "shouldered axes" and a "flat celt" — A Ghosh 1989: 263 (citing S. Asthana); P. Yule 1985: 110.

Axe, misc. — Mohamadabad near Sitapur, Dist. Sitapur, U.P. (c. 27° 34' N; c. 80° 41' E). — D.P. Agrawal 1998: 292, pl. 68 (cf. Yule no. 798 "Kathmandu valley").

Axe, misc. — Kanpur-Unnao border area, U.P. — D.P. Sharma 1998: 292, pl. 69 (cf. Yule no. 798 "Kathmandu valley").

Axe, misc. — Sidhauli, Dist. Sitapur, U.P. (27° 17' N; 80° 50' E). — The GeoNET names server (www.nima.mil) names this place twice; thus its position is unclear. – D.P. Sharma 1998: 292 citing S.B. Singh and S.D. Singh 1972, no page cited. — (comparable to Yule no. 798 "Kathmandu valley"?).

Madhya Pradesh

Bangle II, Axe VII. — Temani, Dist. Chhindwara, M.P. (19° 50' N; 73° 51' E) — reportedly found by Shyamrao Deshmukh in 1989 while ploughing in a field at this locality. — C. Gupta 1997: 221, Fig. 4b; 222, Fig. 5, 223.

Attribution unclear to a Hoard Group

Anthropomorphs of uncertain type (x8). — Bankot. Tehsil Berinag, Dist. Pithoragarh, U.P. (29° 45' N; 79° 52' E). In March 1989 eight anthropomorphs were uncovered while digging a stone quarry close to the Bankot Inter College. Details of the find are unknown. Six hoard objects reportedly are kept with Shri Chanchal Singh Bankoti at Bankot, and one is with the Govind Ballabh Pant Government Museum in Almora. Weight range: 2.15 to 3.15 kg (D.P. Agrawal 2000: 108). Agrawal describes them as, "lugged typed anthropomorphs". Joshi, however, "cast in a tray-like single, open mould as is evident from the flat surface on one face and which in some examples has wrinkled skin..." The description of the pieces suggests that they actually belong to the miscellaneous type of anthropomorph such as that from Dist. Manbhum (cf. Yule no. 539) of the eastern hoards, (M.P. Joshi 1995-96: 25). — M.P. Joshi 1993-94 [1994]: 87; D.P. Agrawal 1999: 195; D.P. Agrawal and J.S. Kharakwal 1998: 123-130, pl. 4.1.

Hoard of artefacts of the Indus Culture

129 objects presumably of copper alloy. — excavated from Surkotada, Dist. Kutch, Guj. (23° 35' N; 70° 00' E). — J.P. Joshi 1990: 266, pl. 46.

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Book Review

Pappu, R.S. 2001. *Acheulian Culture in Peninsular India*. Delhi: D.K. Publishers. Price Rs. 455, pp. 170

This book is a welcome addition to studies of the Indian Palaeolithic. No comprehensive review of the data available on the Indian Acheulian has been published recently. For students and researchers alike it has become an onerous task to find information in the widely scattered articles and often obscure publications. Dr. Pappu's book is exhaustive and comprehensive providing an easy reference point for anyone interested in the subject. A well-written introduction is useful for students to get an idea of the background of the subject. A brief mention of the Acheulian in the world context, research methodology and a history of Palaeolithic research in India are given here. The main chapter is a presentation of the main data — the excavated Acheulian sites that is quite comprehensive. The main limitation of this book is confining the discussion to the excavated sites only, as a large number of Acheulian artefacts have been reported from explorations where they occur as surface finds, usually recently exposed from buried contexts. A small section has been added to discuss some of the most important of the non-excavated Acheulian sites but this coverage is much less complete, with only four additional sites discussed. Quaternary deposits are discussed separately. However this treatment does have its advantages as it allows a concentration on the most important and well-documented evidence and reduces the material to a manageable level especially useful for students and general readers.

Theme wise discussion of the Acheulian in India follows, including discussion of the main archaeological material, the stone tools, the Quaternary deposits in which they are found and the associated animal fossils. Two appendices give a list of the important sites and available dates.

The most useful feature of this publication is that Pappu is comprehensive in his coverage. All published articles are referred to and all excavated sites are discussed. Therefore one can rely on the data and easily go to the original publications if additional information is needed. A good job of extracting the important information from the publications has been done. This makes this publication invaluable for students and researchers alike.

The volume is well produced with a large number of drawings re-produced from the original publications. Compared to present-day prices, it is moderately priced and well worth adding to your personal book collection.

Sheila Mishra
Deccan College,
Pune 411 006.

Book Review

The Saraswati Flows On: The Continuity of Indian Culture, 2002. B.B. Lal. New Delhi: Aryan Books International. Pages 146, Illustrations 114. Price Rs. 1250.

With the discovery of the Indus (now better known as the Harappan or even Indus-Saraswati) Civilization as a result of excavations at Harappa by Rao Bahadur Dayaram Sahni in 1921 and at Mohenjo-daro by Rakhal Das Banerjee in 1922, the history of India was pushed back at one stroke by some 2000 years. In the ensuing years the two sites were extensively excavated, Mohenjo-daro under the direction of Sir John Marshall, then Director-General of the Archaeological Survey of India, and Harappa under the direction of Pandit Madho Sarup Vats. These excavations revealed a rich and highly evolved culture with urban centres, having planned layout, twin components, comprising a citadel on a raised platform and containing public buildings like a college for priests, great bath, granary, and residences for the ruling class and other elite; and a lower town for the common populace.

All the buildings were made of kiln-fired bricks. In the lower town the roads and streets ran in cardinal directions and at right angles to each other. The houses were provided with paved baths and drains that discharged into soakage jars or public drains. A strict municipal administration prevented encroachment on streets and ensured perfect public hygiene. The material culture comprised wheel-turned, finely baked, and elaborately painted sturdy pottery; copper vessels; copper and chert tools; weights, mainly of cubical shape, of chert, limestone, gneiss, steatite, slate, chalcedony, schist, and probably hornblende; measures of copper, shell and ivory; ornaments of gold, silver, shell, ivory, faience, and beads of semi-precious stones, including etched carnelian; intaglio seals of steatite bearing masterly carved figures of animals, notably of the Brahmani bull, and an as yet undeciphered writing; and animal and human figurines in terracotta, stone, faience and bronze, the most notable in the last material being the famous dancing girl of Mohenjo-daro.

The Indus system of weights was extremely precise and unique to the contemporary world. In the lower denominations the system was binary: 1, 2, 1/3 x 8, 8, 16, 32, etc., with the traditional Indian ratio of 16, as in the pre-1957 Indian currency of 16 *annas* = 1 rupee, and weight system of 16 *chhataks* = 1 *seer*. The measures, however, seem to have followed a decimal system (Wheeler 1962: 103-104). The Indus people had extensive internal and external trade, both terrestrial and sea-borne, in raw materials and manufactured goods. Their sea-plying boats, depicted on steatite seals and bronze tablets, were identical to the wooden boats plying on the Indus river today.

Right from the time of the publication of reports on excavated sites, the excavators like Sir John Marshall, M.S. Vats and E.J.H. Mackay, and other writers on the Indus Civilization, like Sir Mortimer Wheeler (1953: 103-104), Bridget and Raymond Allchin (1982: 229-347), B.B. Lal (1997: 257-80), and J.M. Kenoyer (1998: 173-83), to name but a few, have been pointing out survival of Indus elements into later Indian culture, particularly Hinduism and its associated metaphysics. These include worship of proto-Shiva in the form of *Pashupati* or Lord of the Beasts and phallus, animals, particularly bull or *Nandi*, mother goddess, and *pipal* tree. M.E.L. Mallowan (1955: 199-202), in his review of Sir Mortimer Wheeler's *The Indus Civilization*, had also pointed out the continuity in the system of weights and measures. However, no one has documented the varied and rich evidence of the continuity of the Indus Civilization into the later Indian society as thoroughly and competently as Professor B.B. Lal has done in his present book.

But before dealing with the core issue of the book, we must briefly refer to the inseparable relationship between the Indus Civilization and the river Saraswati. Since the time of the composition of the *Rigveda*, over four thousand years ago, the Saraswati has been venerated by the Hindus as one of their holiest rivers; indeed in the *Rigveda* it was held as **the holiest river**. Since 1874 a number of geographers, geologists and archaeologists have identified this river with the dry bed of a large stream known as the Ghaggar in Punjab, Haryana and Rajasthan, and as Hakra, Sotra, Sagara, Wahind, Raini, Mihran and Nara (Narra) in Pakistan (Anonymous 1874; Nearchus 1875; R.D. Oldham

1887; C.F. Oldham 1893; Stein 1917; Wilhelmy 1969; Misra 1984; Yash Pal *et al.* 1984). The scholar, who first associated the Saraswati with the Indus Civilization, was the veteran explorer, Sir Aurel Stein. In the winter of 1941-42 Stein explored the Ghaggar-Hakra valley in the then Princely States of Bikaner and Bahawalpur and discovered some fifty protohistoric, including Indus, sites (Stein 1942).

After Independence a number of archaeologists like A. Ghosh, Katy Frenchman, J.P. Joshi, M.N. Deshpande, K.N. Dikshit, R.S. Bisht, B.M. Pande, and others of the Archaeological Survey of India; Suraj Bhan of Kurukshetra University; R.N. Mehta, K.T.M. Hegde, V.H. Sonawane, K.K. Bhan, and others of M.S. University of Baroda; and archaeologists of the Punjab, Haryana and Gujarat State Archaeology Departments in India; and M.R. Mughal and Louis Flam in Pakistan, among others, have discovered a very large number of Indus sites. Today over 1500 sites of the Indus Civilization are known in India and Pakistan. Of these, about two-thirds are located along the banks of the Saraswati or Ghaggar-Hakra river. In the Cholistan desert of Pakistan alone Mughal (1992) has discovered over 300 sites. As against this, less than fifty sites are located on the Indus river after which the Civilization is named. It is, therefore, no surprise that S.P. Gupta (1996) thought it proper to rename the civilization as the Indus-Saraswati Civilization.

The author of the book, Professor B.B. Lal, has had a spectacularly successful and 'and exemplary archaeological career spanning more than half-a-century. He was trained in excavation by the veteran archaeologist, R.E.M (later Sir) Wheeler at Taxila, Harappa and other famous sites in the forties of the last century. Out of his many pupils Wheeler chose Lal to entrust the excavation of the Early Historic site of Sisupalgarh in Orissa before relinquishing the charge of the Director-General of Archaeology in India in 1947. Immediately after successfully completing and publishing this excavation, Lal took up the highly challenging project of investigating the archaeology of the *Mahabharata* sites during 1950-52. He discovered many Painted Grey Ware (PGW) sites in the Indo-Gangetic Divide and upper Yamuna-Ganga doab, and excavated Hastinapura, the capital city of the Kurus. To him goes the credit of associating the PGW with the *Mahabharata* sites and recognizing the PGW culture as a manifestation of the later Vedic culture. The eminent British archaeologists, Stuart Piggott and D.H. Gordon, in their reviews of B.B. Lal's classic article on the Copper Hoards of the Gangetic basin (Piggott 1954), and his Hastinapura excavation report (Gordon 1957), both published in *Ancient India*, the annual journal of the Archaeological Survey of India, hailed them as models of research and excavation reporting. In subsequent years Lal excavated the Mesolithic site of Birbhanpur in West Bengal, the Chalcolithic site of Gilund and the Harappan site of Kalibangan, both in Rajasthan, and the *Ramayana* sites of Ayodhya, Bharadwaj Ashram, Nandigram, Chitrakut and Shringaverapura in Uttar Pradesh.

Very early in his career Lal established a sound and enviable reputation for precise, succinct and lucid writing. He is extremely particular about the veracity of his facts, choice of apt words, accuracy of references, and minutiae of punctuation marks. He argues his case like an accomplished and veteran advocate, cogently and point by point, citing solid evidences in support of it, and bringing it to an irrefutable conclusion.

Today Professor Lal is indisputably the most experienced and distinguished archaeologist of India. For his monumental scholarship, becoming humility, in conformity with the Sanskrit *subhashit, Vidya Vinayen Shobhate,* and his eagerness to help every archaeologist, young or old, he is held in the highest esteem by the entire Indian archaeological community.

For his academic achievements and the high quality of his scholarship Professor Lal has been honoured by many prestigious institutions in India and abroad. In 2000 the President of the Indian Republic conferred upon him the coveted title of *Padmabhushan.*

In addition to his many articles on the excavations, conducted jointly by him and the late Shri B.K. Thapar, on the important Indus Civilization site of Kalibangan, a provincial capital city of the Indus Civilization, the Indus/Harappan Civilization in general, and the related subjects of Copper Hoards and Ochre Coloured Pottery (OCP), published in prestigious national and international journals, Lal has already published two books on the Indus/Harappan Civilization (Lal 1997, 1998). The book under review is a fitting sequel to these earlier publications.

After these introductory comments, let us get back to the review.

In Chapter I the author describes the location of the Rigvedic Saraswati on the basis of the Rigvedic hymns, between the Yamuna in the east and the Sutlej in the west, and he cites many hymns, sometimes with his own English translation of them, which vividly portray the many attributes, particularly the grandeur and exceptional sacredness, of the river. In chapter II he makes out a strong case that the Rigvedic Saraswati cannot be any other river except the dry bed of the present-day Ghaggar-Hakra river. This is because the Rigvedic hymn 10.75, Verses 5 and 6, clearly place the Saraswati between the Yamuna and the Sutlej. Several western and Indian scholars have identified the Saraswati with the Harakhvati or the present-day Helmand river of Afghanistan. This identification is untenable because the Saraswati in the Rigveda is described as originating in the mountains and debouching into the ocean whereas the Helamnd debouches into a lake. Besides, there are no rivers named as Yamuna and Sutlej in Afghanistan. In addition, the author provides additional evidence from the writings of Yash Pal *et al.* (1984), V.N. Misra (1984), V.M.K.Puri and B.C. Verma (1998), and Louis Flam (1999) to establish that the Rigvedic Saraswati could have been no other river than the present-day Ghaggar-Hakra of India and Pakistan.

Lal's formidable arguing and writing skills are in full evidence in his treatment of the vexed Saraswati problem.

Against the overwhelming evidence in support of the Saraswati being an Indian river and majority of the Indus sites being located along its banks, the remarks of the well-known historian, R.S. Sharma, come as a rude shock. Sharma (1999: 35) says, "The **fundamentalists** want to establish the superiority of the Sarasvati over the Indus because of **communal** considerations. In the Harappan context they think that after partition the Indus belongs to the Muslims and only the Sarasvati remains with the Hindus" (emphasis B.B. Lal's).

The fact, however, is that no scholar of repute has made such a statement. The Indus, even though today, flows, for most of its length, through Pakistan, is very much an Indian river as well for it reaches Pakistan only after flowing through Kashmir. Besides, as Sir Mortimer Wheeler (1959) said in his book, *India from the Earliest Times to Ashoka*, the Indus gave India her name and the Ganges gave her faith. So no sane scholar can make such a foolish and rabid statement.

Chapter III is devoted to presenting a brief and compact but masterly account of the Indus Civilization from its birth through maturity to decline, including the long-discredited theory of 'Aryan Invasion' being a major factor in the so-called 'Extinction' of the Civilization, still parroted by some Marxist historians.

Chapter IV comprehensively deals with the core issue of the book, the continuity of the Harappan Civilization into the present. Here the author discusses the numerous examples of continuity in various spheres of life and society, like ornaments, make-up and toiletry; games and recreation; house- and town-planning; cooking and associated items; agriculture and water-management; transport, on land and water; crafts; folk tales; religion; social hierarchy; and script. The author eminently succeeds in impressing upon the reader the deep and abiding imprint of the six-thousand year old civilization on our day-to-day life. He supplements the text with high quality black-and-white as well as colour photographs of Indus Civilization items and their contemporary parallels.

While each picture has a story to tell and bears equal importance, the reviewer finds the following ones particularly appealing: terra-cotta female figurine with vermilion in the parting of her hair, *maang*, from Nausharo, juxtaposed with a picture of Shrimati Rabri Devi, Chief Minister of Bihar, wearing the same symbol of marital status; Mohenjo-daro bronze dancing girl wearing spiral bangles and a living woman from northwestern India sporting similar ornaments; three-in-one toiletry gadget from Harappa with an identical modern parallel; terra-cotta chess gamesmen from Lothal and a modern chess board with gamesmen; Early Harappan ploughed field with criss-cross furrows from Kalibangan and an identical modern field from the same place; pottery *kamandalu* from Mohenjo-daro and a *Sadhu* using a similar *kamandalu*; sea-plying boat depicted on a Mohenjo-daro seal and its modern Indus river equivalent; terra-cotta figurine doing *namaste* from Harappa and senior politicians greeting the Indian President with similar *namaste*; and terra-cotta writing tablets, *takhtis*, from Mohenjo-daro with the present-day children writing on similar wooden *takhtis*, much as the children of the author's and reviewer's generation did.

The late George F. Dales ((1977), excavator of the Harappan sites of Sutkagen-dor, Mohenjo-daro, Balakot, and Harappa, had drawn similar parallels between Harappan objects and items of Pakistani life, but obviously the author of the book under review did not have access to this publication. A surprising omission, given the author's thorough mastery over the subject, is the absence of a reference to Harappan system of weights and measures to which Max Mallowan (already cited) had drawn our attention twenty-seven years ago.

The author's role model in archaeological research and writing is his *guru*, the late Sir Mortimer Wheeler. This distinguished archaeologist wrote in his autobiography, *Still Digging*, that his father taught him early in his childhood that while writing anything one should think that one is sending a telegram and that every word costs money. Professor Lal fully imbibed this precept from his *guru*. Naturally, all his writings are marked by precision, brevity and elegance of prose. Just as Sir Mortimer was a role model to young B.B. Lal, the latter is a role model to all archaeologists of my generation as well as to the aspiring archaeologists of generations younger than mine.

The book under review, displaying the author's thorough mastery on the Indus Civilization and close observation of the ethnographic scene, will educate the enlightened public about the roots of the present-day Indian society and culture being located in this ancient civilization. It must be made a compulsory reading for the university and college students of both sciences and humanities and should have a place on the shelf of every public and individual library.

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V.N. Misra
G-2, B Wing, Ganga Park
Mundhwa Road
Pune 411 036
misravn@vsnl.net

Book Review

Rock Art in Orissa. 2001. Sadasiba Pradhan. New Delhi: Aryan Books International. Pages 82, Illustrations 73. Price Rs. 950.

The richness of India's prehistoric, specially rock art, can be compared only with that of Africa and Australia. The richest area of rock art in the country is the region covered by Vindhyan sandstone in central India, mainly in the State of Madhya Pradesh, but to some extent also in the adjoining States of Uttar Pradesh, Rajasthan, Bihar, Chattisgarh, Jharkhand and Orissa. They occur in open, shallow shelters on the walls, ceilings and in the niches. The paintings are executed mainly in various shades of red and in white colours but to some extent also in green and yellow. The paintings can be mainly divided into two cultural and chronological stages. The older ones mainly depict wild animals and hunting scenes and belong to the Mesolithic period, and the younger ones depict domestic animals and battle scenes and belong to the Historic period.

While the prehistoric art of western Europe almost entirely belongs to the Upper Palaeolithic period, most of the Indian prehistoric art belongs to the Mesolithic period. The European art, both parietal and portable, is better known because of the greater volume of research, dramatic quality of the paintings and sculptures, better preservation because of the location of paintings and engravings deep inside limestone caves and temperate climate, and secure dating by radiometric techniques. In India even though rock paintings were discovered by A.C.L. Carlleyle in the rockshelters in Kaimur hills in Mirzapur district of Uttar Pradesh as early as 1867- 68, barring sporadic enquiries by J. Cockburn and C.A. Silberrand in the same area, Manoranjan Ghosh at Adamgarh, D.H. and M.E. Gordon at Pachmarhi, both in Madhya Pradesh, and F.Fawcett in Karnataka and Kerala, the subject was totally ignored by professional archaeologists. The main reasons for this neglect were: (a) the location of paintings deep inside forests and hills, infested with wild animals and snakes, and inaccessible because of lack of roads; and (b) serious problem of dating the paintings except in a relative manner on the basis of superimpositions.

An interest in the rock art was rekindled almost single-handedly by the late Vishnu Shridhar Wakankar in the fifties of the last century. Wakankar was a painter by temperament and training. As a devoted and active follower of the Rashtriya Swayam Sevak Sangh, the muchmaligned cultural organisation, he was involved in the educational work among the *Adivasi* or aboriginal children. Since the aborigines live in the hills and forests, and the rock paintings are also located in the same environment, it was but natural for Wakankar the artist to notice and be drawn to these paintings. For nearly four decades, from around 1950 to his untimely death in 1989, Wakankar roamed the jungles of his native State of Madhya Pradesh, studying, photographing and sketching the paintings and lecturing and writing on them. A chance meeting with R.R.R. Brooks, Cultural Attache in the U.S. Embassy in New Delhi, at his hometown, Ujjain in the early seventies, led to collaboration between these two scholars, and together they published several articles and a book on the rock paintings. Wakankar's enthusiasm was infectious, and anyone who came into contact with him could not but be affected by his obsession with rock art. A number of persons, most of them young, were inspired by Wakankar to take up rock art research. These include Jagdish Gupta, Yashodhar Mathpal, Erwin Neumayer, Giriraj Kumar, Rakesh Tewari, S.K. Pandey, A. Sundara, R.K. Verma, K.K. Chakravarty, R.K. Pancholi, Meenakshi Dubey-Pathak, N. Chandramouli and Sadasiba Pradhan.

Mathpal made an intensive survey of Bhimbetka shelters and produced a Ph.D. thesis and a book. Neumayer has written two books, one on Bhimbetka and the other on India as a whole. S.K. Pandey has published a book on central India, and K.K. Chakravarty has brought out two edited volumes. Others have published a number of articles. About two decades ago Giriraj Kumar established Rock Art Society of India. The Society holds its annual conferences and publishes quarterly journal, *Purakala.* Thanks to the work of these scholrs. Rock art research is now solidly established in India.

Orissa, the easternmost region of Indian rock art, was, until recently, *terra incognita.* This lacuna has been successfully filled by the dedicated work of Sadasiba

Pradhan over last several years. Pradhan has carried out extensive explorations in several districts and located a large number of shelters containing paintings, engravings and grinding and pounding holes. Analysis of these artistic products is presented in this study.

The slim book is divided into six chapters. Chapter 1 describes the global distribution of rock art, and history and current status of rock art research in India. Chapter 2 is devoted to a brief description of the drainage, climate and people of Orissa. Chapter 3 provides a summary of the cultural history of Orissa during prehistoric and historic periods. Chapter 4, devoted to rock art in Orissa, forms the core of the book. It gives an account of the survey of rock art sites, paintings, engravings, grinding and pounding holes, associated archaeological evidences, and discusses the dating and chronology of rock art. Apart from the discussion of individual sites and art creations on them, the chapter has several very informative tables. Table 1 gives a list of 55 rock art sites in seven districts of Orissa along with the name of the Reserve Forest in which they are located, district, orientation, facing, length, depth and height. Table 2 provides aspects of rock shelters on paintings, engravings, subject matter of depiction and cultural remains. Table 3 gives a list of the microlithic tool types from trench – I of Lekhamoda shelter and Table 4 provides a list of other objects from the same shelter. The chapter also provides beautiful colour photographs and line-drawings of the paintings, engravings, cupules, faceted haematite nodules produced by the rubbing of the nodules for production of pigment, microliths, ground stone celts, mace-heads or ring-stones, mat-impressed pottery, grinding and pounding holes, paintings on the pottery of the Neolithic- Chalcolithic site of Golbai-Sasan, and paintings produced by the Saura and Juang tribal people of the State.

The subject matter of the rock paintings and engravings includes wild animals like deer with bodies filled with cross-hatches and dots and geometric symbols like small dashes, crescents, squares, suspended loops, triangles, wavy lines, wheels, etc. and hand impressions. Unlike the central Indian rock art which abounds in paintings, the Orissan rock art appears to contain more engravings and cupules or pitted holes. The animals and birds depicted include deer, goat, wild boar, lizard and peacock. Most of the paintings and engravings are stylized and therefore relatively late. Some shelters contain a large number of cupules which are arranged either in long parallel rows or haphazardly. The animals shown in the paintings and engravings are indistinct and in most cases it is difficult to make out their correct identity.

Chapter V gives an account of the paintings of Saura and Juang tribes and also points out parallels between archaeological and ethnographic art. Chapter 6 gives a summery of the study.

The author has provided good maps of rock art regions in the country, Orissa and local maps of rock art sites in Jharsuguda, Sundargarh and Sambalpur districts.

The quality of photographs, drawings and maps is excellent and the photographs are printed on art paper. The small book makes an original contribution to our knowledge of the rock art. Both the author Prof. Sadasiba Pradhan and the publisher Mr. Vikash Arya deserve our congratulation for bringing out this attractively produced volume. As the author is continuing his investigations on the subject and other scholars are also working, I am sure very soon he will have to bring out an enlarged and revised edition of this book.

V.N. Misra
G-2, B Wing, Ganga Park
Mundhwa Road
Pune – 411 036
misravn@vsnl.net

Book Review

Cornaline de l'Inde-des pratiques techniques de Cambay aux techno-systemes de l'Indus. *2000. Valentine Roux. Paris: Editions de la Maison des Sciences de l'homme. Pages 545, Price 450F/ 68.60 Erou.*

This book comes with a PC/Mac compatible CD-ROM. Scientific constructs are presented in a formalized way for quick access to the main results as well as easy consultation of the large-size scientific data base (photos, films, graphics). Though the book is in French, each chapter carries an English summary.

The book is the outcome a research project on ethno-archaeological studies of the lapidary centre at Cambay, a small city in the State of Gujarat, situated at the extreme southern point of the Gulf of Cambay where lapidary activity is known from literary sources from the seventh century. Cambay is one of the few places in the world where hard stone beads are still fabricated by the millions using traditional techniques In the recent past several scholars have attempted to record the bead manufacturing activity and various processes involved in it. This craft of carnelian bead production goes back several thousand years. Cambay offers a unique opportunity for researchers to build a modern reference base. Historical and ethnographic records show that beads play an ornamental or symbolic role in our society, representing immense diversity of social status, value and ideology. The variability seen in their size, forms, nature of raw material used and the manufacturing processes involved make them model artefacts packed with a lot of cultural information.

In the absence of evidence for relation between the past and present societies, the ethnographic data can be usefully utilized for understanding past societies. The present study by Valentine Roux and her team of researchers is extremely fascinating and academically rewarding. It is all the more important because this old craft and craftsmanship are rapidly vanishing. Roux says " I returned to Cambay in December 1998. Fifty percent of the workshops had ceased all activity...".

To record this ancient technology Roux has employed all possible and necessary methods and scientific techniques available. The research has resulted in providing interpretive rules relating to technical process, techno-system and knapping skills. Her findings help in interpreting the beads from Harappan settlements and sites in Mesopotamia in terms of production and distribution networks. This interpretation allows the formation of new propositions concerning the function of certain beads and conditions of their appearance. These hypotheses can be further extended and verified from the evidence of later periods.

The objective of this research was to define the "universal" characteristics of the technical practices related to the manufacturing of semi-precious hard-stone beads and utilize them for the interpretation of beads found in archaeological contexts. In the light of the ethnographic observations it is seen that in the production of Harappan long barrel carnelian beads a different and new technique was applied.

The objective of the work has been very precisely defined. First it has tried to develop a modern reference-base that permits the interpretation of archaeological beads and the second purpose has been to study semi-precious stone beads from the Indus Valley to propose "hypothesis concerning the dynamic of the origins of the Harappan civilization (3rd millennium B.C.)" Moreover, beads were circulated over long distances and they are the perfect non-consumable objects in demonstrating the existence of exchange and commerce. To understand this phenomenon all possible scientific approaches like experimental, comparative and contextual have been applied.

The findings of this research have been organized in nine chapters. Two-thirds of the chapters are ethno-archaeological studies conducted with the objective of developing interpretive references applicable to hard stone beads and the remaining one-third are comprised of archaeological studies.

Chapter one reviews the historical and ethnographical background and the necessity and prospects of working at Cambay and its relevance to the archaeological world. Chapter two gives an account of the knapping techniques practiced at Cambay and compares them with the techniques used in the production of Harappan beads. It also brings out different processes and methods associated with different types of the beads at different stages of production. The variety of forms, shapes, dimensions, quality of raw material and the end product are related to different knapping methods which morphologically fall into three major families.

Chapter three deals with the most vital aspects of bead production/fabrication. They are grinding, polishing and shining. These procedures leave impact of different quality on beads and this is attributed to the techniques employed and time invested. Hence beads of different quality (shape, size and finish) reflect the manufacturing centre and their owner's status. Their identification in archaeological context can reveal rich information regarding the origin and circulation of different types of beads, as well as the social groups that wore and probably exchanged them. Recognition of these attributes has been possible to some extent by doing microscopic analysis using SEM and optical microscopes to observe the bead surfaces. These processes have been supported by the measurements of roughness on finished beads and also beads taken from different stages of finishing procedures. This permits the identification of different polishing techniques used by the Harappans as well as by later societies. These chapters document ethnographic data destined to disappear in the near future.

This analysis provides information regarding the transformation which takes place on bead surfaces during each stage of fabrication according to the technique applied and helps in identifying diagnostic characteristics left by different production processes. These observations may enable us to analyze and identify the beads from archaeological contexts to their source of origin and passage of movement.

The authors have applied these findings to Harappan beads and the results have been encouraging. They suggest that the Harappan classical beads were produced at different centres.

Chapter four deals with the perforation of beads by traditional techniques. The experiments carried out at Cambay take into account the various properties of raw material, like hardness, tenacity and resistance to abrasion and try out different types of drills visualized by Kenoyer and Vidale. (1992). The results suggest that the large " classical Harappan beads could only be drilled using drill bits of ernestite, a stone that contains titanium oxide, known for its exceptional qualities".

Chapter five discuses the skills of chalcedony bead knappers. There are different skill-levels of craftsmanship and the quality of beads depends on the skill-level of apprenticeship in terms of years. The most competent knapper is one who knaps beads of high quality of all shapes and dimensions and has an apprenticeship period of not less than ten years. Knapping skills permit the identification of the workshop and the artisan. These factors are essential to understanding the evolution of techniques and organization of production. Applied to archaeological data, these hypotheses may permit interpretation of different bead types in terms of skill level and apprenticeship duration.

Chapter six is devoted to understanding the techno-economic organization of stone bead makers in the Indus Valley on an ethnographic model based on the Cambay experimental data. It gives details of the quantification of production and predicts alternative forms of organization in an archaeological context. In Cambay the technical sequences i.e. raw material, knapping, abrading, drilling and polishing of a bead are specific to each bead type and class. They are invariably related to the specialist craftsmen involved, the amount of energy expended and the type of instrument used, etc. Based on data from Cambay and the techno-economic model emerging out of this study, if applied to archaeological data could provide us information about beads in relation to annual production and number of artisans involved.

Chapter seven applies information derived from Cambay to experiments of the Harappan stone bead techno-system. Hard stone beads were circulated over long distance, thus demonstrating the existence of a system of exchange and/ or commerce. Bead production was intensified during the third millennium. This exercise permits estimating and quantifying the number of large classical Harappan beads produced. It seems they did not exceed a few hundred and probably were fewer than 500. It can be inferred that medium and small size beads were 10 and 100 times more numerous than classical Harappan beads. Hence their importance in the archaeological context, their distribution and their value/status in the culture, social, economic or religious, is enormous. The production processes of this craft and their interpretations contribute to the understanding of role of craftsmanship in the formation of urban state and the process of urbanization. The archaeological hypotheses proposed could be modified or confirmed following new discoveries.

Chapters eight and nine deal with the stone beads from Nausharo and Indus beads found in Mesopotamia to answer some of the pertinent questions generated during the Cambay project. The beads from these sources have been analyzed in the light of findings from Cambay. The findings strengthen the hypotheses propounded in the course of ethnographical studies at Cambay. The interpretations are testable by ethnoarchaeological data. The observations on carnelian beads found in Mesopotamia shed light on questions concerning production centres and the relations between the great civilizations of the period i.e. Indus, Mesopotamia and Egypt.

The outstanding quality of this work has been possible because of the admirable effort of a group of experts, who have come together to produce a work of interdisciplinary nature. This work has made a significant contribution to our knowledge of the value of craft specialization in the society. It will inspire other scholars in the field of bead research.

This excellent scholarly work will be greatly appreciated by bead researchers. It applies all possible modern scientific methods and theories related to this field. It has arrived at logical, systematic and scientific conclusions. The research methodology has been rigorously applied with caution and discipline. This has allowed observing in minute detail the marks left in the process of fabrication of beads. The book has devoted a large part to explaining the scientific methods, underlying principles and theories prevalent in the modern day research. It will be a reference work for bead researches.

The main emphasis of the work has been the techno-archaeological study. The authors are well aware that an integrated approach taking into consideration the socio-cultural system responsible for bead production can do justice to the work. The presentation of quantified data through numerous tables adds to the value of the text. The expertise and skill of craftsmen is very competently conveyed to the readers. The psychomotor analysis clearly brings out the different skill levels. Some readers may find it difficult to follow the logic of computation and the optimization of procedures but it has been done with scientific temper to arrive at rational conclusions. The morphological analysis of beads is left out because it is of little help in drawing the kind of techno-economic inferences that are aimed at.

The CD-ROM, which accompanies the book, provides a medium that is going to be popular in the future and will allow easy access to the data.

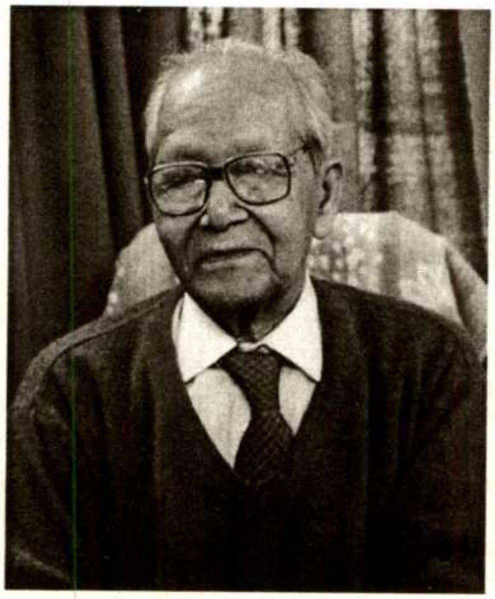
The study deals in great detail with a subject which was otherwise treated in most of the excavation reports under sub-heading of Small Finds and merely described the shapes, sizes and raw material. Valentine Roux has elevated the bead study to a level where beads can be seen as highly specialized craft objects.

Reference

Kenoyer, J.M. and M. Vidale 1992. A New Look at Stone Drill of the Indus Valley Tradition, in *Material Issues in Art and Archaeology* (P. Vandiver Ed.), pp. 497-517. Pittsburgh, Pennsylvania: Material Research Society.

R.K. Mohanty
Deccan College
Pune 411 006

Obituary



Krishna Deva

(1914-2001)

Shri Krishna Deva, at the time of his death on eighth October 2001, was the senior most and most respected archaeologist of India. He had a long and eminently successful career spanning more than 60 years. He passed his M.A. in Ancient Indian History and Culture from Banaras Hindu University in First Class in 1937 and served as an assistant professor for one year (1937-38) in the same department. In 1938 he joined the Archaeological Survey of India (ASI) as a scholar and retired as Deputy Director General in January 1973.

Krishna Deva began his research career with the explorations in Sindh under the direction of N.G. Majumdar. It was during this expedition that Majumdar was shot dead by a dacoit while he was standing outside his tent and Krishna Deva was a witness to this most unfortunate incident which cut short a brilliant career. During 1942 Krishna Deva assisted the veteran explorer, Sir Aurel Stein in his explorations in the then Princely States of Bikaner and Bahawalpur. These explorations led to the discovery of some 50 proto-historic, including Harappan, sites along the dry course of the Ghaggar-Hakra river which Stein, in conformity with the earlier writings of C.F. Oldham and R.D. Oldham, identified with the Saraswati of the Rigveda. In subsequent years Krishna Deva participated at excavations at Ahichchatra under the direction of Rao Bahadur K.N. Dikshit and at Taxila, Harappa and Arikamedu under the direction of Sir Mortimer Wheeler. He prepared the pottery reports of these sites which became model for subsequent pottery reports.

Krishna Deva independently conducted excavations at Rajghat (Varanasi) in 1940, at Nagar near Jaipur in 1943, at Vaishali in 1950 and at Kumrahar (Pataliputra) in 1951-52 and at Kashipur in the 50s. As superintendent of several circles of the ASI he acquired intimate knowledge of various categories of archaeological objects and monuments and carried out conservation of several monuments.

Krishna Deva was put in charge of the newly started Temple Survey Project for North India and held the post for a decade. During this period he carried out extensive surveys of temples all over North India and particularly in Central India from 1956-1962. He was also deputed by the Government of India to carry out an iconographical and sculptural survey of the images in Nepal. He held the post of Director of the ASI for six years and of the Deputy Director General for three years.

After his retirement from ASI Krishna Deva served as Archaeological Adviser to His Majesty's Government of Nepal (1973-75), as Director, Birla Academy of Art and Culture, Calcutta (1975-77) and as Research Consultant to the American Institute of Indian Studies, Varanasi (1977-87). At the time of his death he was engaged, jointly with

Shri J.P. Joshi, a former Director General of the ASI, in preparing an Inventory of Protected Archaeological Monuments of the country. Most of the work of this project was completed.

Although he worked on a variety of subjects, Krishna Deva's chief interest was temple architecture on which he was the foremost authority. He has written extensively on the subject. He wrote majority of the chapters of Volume 2 of the *Encyclopedia of Indian Temple Architecture*, a prestigious project of the American Institute of Indian Studies, and was its chief coordinator.

Krishna Deva had travelled extensively in India and abroad and participated in many Indian and International seminars and conferences on Indian Art and Archaeology. He presided over the Technical Arts Section of the All India Oriental Conference held at Srinagar in 1961 and in the International Symposium on Siva held at Philadelphia in 1981 and lectured in several American and British Universities on Indian art and architecture. In 1996 he delivered the prestigious H.D. Sankalia Memorial Lecture on Ramayana Depictions in Indonesia at the Annual conference of the Indian Society for Prehistoric and Quaternary Studies held under the auspices of the Department of Ancient Indian History and Culture, Rohilkhand University, Bareilly. He was editor of the *Journal of the Indian Society of Oriental Art* and author of numerous research papers and books. Among his more famous book are *Temples of North India*, *Khajuraho*, *Images in Nepal*, *Temples of Khajuraho* (two volumes), and *Stone Sculptures of Allahabad Museum*.

Krishna Deva was a man of great erudition. Yet he was an extraordinarily simple, unassuming, polite and soft-spoken person. He always took interest in the career and welfare not only of his immediate colleagues but of all upcoming scholars and by his attitude towards them made them feel important. He was truly an Ajatashatru and was held in the highest esteem and loved by all archaeologists, young as well as old. In 2001 the Executive Committee and General Body of the Indian Society for prehistoric and Quaternary Studies chose him for honouring with the first Prof. R.K. Sharma Award which has been instituted from a munificent donation given to the Society by Prof. R.K. Sharma, retired Professor of Ancient Indian History, Culture and Archaeology, Rani Durgawati Vishwavidyalaya, Jabalpur. Unfortunately, he passed away just two months before the date of the Award. The Award was finally given to him posthumously and was received on his behalf by his dear friend and equally eminent archaeologist, Prof. B.B. Lal, on 22nd November 2001 during the XXIX Annual Conference of the Society held under the auspices of the Department of Ancient History and Archaeology, M.S. University of Baroda at Vadodara.

The entire community of archaeologists interested in the archaeology of South Asia, particularly in art and architecture, deeply mourns the passing away of this outstanding scholar and extraordinarily fine gentleman.

Select Bibliography of Krishna Deva:

1950. *Excavations at Vaishali*, Vaishali Sangh, Bihar.

1967. *Guide to Khajuraho*. New Delhi: Archaeological Survey of India.

1969. *North indian Temples*. New Delhi: National Book Trust.

1984. *Images of Nepal*. New Delhi: Archaeological Survey of India.

1987. *Khajuraho*. Delhi: Brajabasi Printers.

1988. *Temples of Khajuraho* (two volumes). New Delhi: Archaeological Survey of India.

1996. *Stone Sculptures in Allahabad Museum*. New Delhi: American Institute of Indian Studies.

In addition, he published more than 50 research papers and wrote foreword/ book reviews of over 20 publications. He contributed chapters to more than a dozen prestigious volumes on Indian History, Art and Archaeology. Some of these volumes are:

1964. *Archaeological Remains, Monuments and Museums*. New Delhi: Archaeological Survey of India.

1970. *India's Contribution of World Thought and Culture*. Madras.

1975. *Studies in Indian Temple Architecture*. Banaras: American Institute of Indian Studies.

1975. *Jaina Art and Architecture* (three volumes). Delhi: Bharatiya Gyanpith.

1981. *Chhavi – 2*. Banaras: Bharat KalaBhavan.

1983. *Dinesachandrika – Studies in Indology*. Delhi.

1984. *Discourses on Sival*. Philadelphia and Bombay.

1985. *Indian Epigraphy – Its bearing on History of Art*. Delhi

V.N. Misra
G-2, B Wing, Ganga Park
Mundhwa Road
Pune 411 036
misravn@vsnl.net

Indian Society for Prehistoric and Quaternary Studies

c/o, Department of Archaeology, Deccan College, Pune 411 006

Report of the General Secretary for 1999-2000 (01.04.2000 to 31.03.2001)

The functioning of the Society during the year ending on 31-3-2001 has been quite satisfactory, both academically and financially. The regular activities of the Society were carried out successfully. The financial position is reasonably sound because of the interest accruing on the fixed deposits and annual grants from the Archaeological Survey of India for publication of the Journal and from the Indian Council of Historical Research for publication of the Journal as well as for organizing the annual conference. We are grateful to these organizations for their financial support. An Audited Statement of Accounts of the Society for the year has appeared in the last issue of *Man and Environment* XXVI(1).

Man and Environment

This is the twenty-sixth year of the publication of the Journal and fourteenth year of its biannual publication. The last two issues of the Journal have been slightly delayed because of technical problems. However, the Journal has maintained its standard and continues to attract a wide range of manuscripts by scholars from within and outside the country. The circulation of the Journal is steadily increasing.

We sincerely thank Mr. Sujit Patwardhan and his staff at Mudra Press for their excellent cooperation in the production of the Journal.

Annual Conference

The XXVIII Annual Conference of the Society was held, in conjunction with the XXXIV Annual Conference of the Indian Archaeological Society and XXIV Annual Conference of the Indian History and Culture Society, and the Seminar on the Indus Valley Civilization, under the auspices of the Indian Archaeological Society at the National Museum, New Delhi, from 1 to 3 December 2000.

The following life members of the Society participated in the conference:

D.P. Agrawal, R.C. Agrawal, P. Ajithprasad, Shahida Ansari, , Banani Bhattacharya, Kuldeep K. Bhan, P. Binodini Devi, R.S. Bisht, Subrato Chakrabarti, P.P. Dandwate, Arati Deshpande-Mukherjee, K.N. Dikshit, Sushma G. Deo, B.C. Deotare, K.R. Dikshit, Kiran Dimri, H.N. Dutta, Sanjay Eksambekar, Rohita Eswar, Y.S.,Farswan, Savita N. Ghate, Giriraj Kumar, M.C. Gupta, Sunil Gupta, S.P. Gupta, R.V. Gurjar, Rajaram Hegde, P.P. Joglekar, P.S. Joshi, Praveen Joshi, M.D. Kajale, B.M.Khanduri, Ravi Korisettar, K. Krishnan, B. B. Lal, V.N. Misra, V.D. Misra, Sheila Mishra, R.K. Mohanty, Malti Nagar, Jagat Narayan, Ramesh Kumar Pancholi, J.N. Pal, J.N. Pandey, Arakhita Pradhan, Vijaya Prakash, P.M. Saklani, Vijay Sathe, K.S. Saraswat, R.K. Sharma, T.C. Sharma, Y.D. Sharma, K.S. Shukla, Ajoy Kumar Sinha, Manoj Kumar Singh, Vijay Singh, J.P. Srivastava, V.H. Sonawane, Devi Prasad Tewari, Capt. R.S. Thakur, P.K. Thomas, Sila Tripati, D.N. Tripathi, Vibha Tripathi, Balaram Tripathy, T.P. Verma, R.K. Verma.

Inaugural Function

The conference and associated activities were held in the auditorium and other halls of the National Museum. Dr. R.D. Chaudhury, Director-General of the National Museum, and Professor V.N. Misra, General Secretary of the Society, welcomed the guests on behalf of the National Museum and the three societies, respectively. Prof. B.P. Sinha presided on the occasion. The conference was inaugurated by Shri Ananth Kumar, Hon'ble Minister for Culture and Tourism, Government of India. The Hon'ble Minister assured all help from the Government for the promotion of archaeological activities. He also released *Puratattva*, Volume XXXII, Journal of the Indian Archaeological Society, and the inaugural volume of *History Today*, Journal of the Indian History and Culture Society. Others who spoke on the occasion included Dr. S.P. Gupta, Chairman of the Indian Archaeological Society, and Shri Vaidyanath Aiyar, Secretary, Department of Culture and Tourism, Government of India.

Presidential Address

The Presidential address of the Society was delivered by Prof. K.R. Dikshit on **Prehistoric Sites and Settle-**

ments: A Palaeogeographic Perspective.

Professor H.D. Sankalia Memorial Lecture

The Tenth Professor H.D. Sankalia Memorial Lecture was delivered by Prof. D.P. Agrawal. The topic of Dr. Agrawal's Lecture was **The Idea of India and its Heritage: The Millennial Challenges.**

Prof. H.D. Sankalia Young Archaeologist Award

Shri Abhijit Majumdar, Research Scholar of the Department of Ancient History and Archaeology, M.S. University of Baroda, Vadodara, presented his paper, entitled **Emergence of Early Harappans in North Gujarat,** and the referees nominated by the Society unanimously selected his paper for the Award.

Dr. Malti Nagar Ethnoarchaeology Award

Ms. Shahida Ansari, Research Scholar of the Department of Archaeology, Deccan College, Pune was the only candidate for Dr. Malti Nagar Ethnoarchaeology Award. Her paper **"Fishing Practices among the Mallahs of Allahabad District, Uttar Pradesh"** was unanimously selected for the Award.

Special Lecture

Professor B.B. Lal delivered a special lecture on new developments on the Indus Civilization.

The academic sessions of the conference were held from the afternoon of the 1st to 3 December.

The following papers were presented at the Conference:

Subrato Chakrabarti and Banani Bhattacharya: Mesolithic Industry from Bankura: A Preliminary Study.

Balaram Tripathy: Early Historic Trade in Orissa: The Archaeological Evidence.

P.S. Joshi: A Link (Overlap?) between Early Historic Culture and the Megalithic Culture of Vidarbha.

P.P. Dandwate and B.S. Gajul: Educational Activities in the Archaeology Museum, Deccan College, Pune.

Kuldeep K. Bhan: In the Sand Dunes of North Gujarat.

R.K. Mohanty: Excavations at Karondiya 1999-2000: A Preliminary Report.

B.C. Deotare, M.D. Kajale, V.D. Gogte and S.N. Rajaguru: On the Archaeology and Pollen Analysis of Kanod Playa, District Jaisalmer, Rajasthan.

Vijay Sathe: Taphonomic Considerations of Microvertebrate Skeletal Assemblages.

P.K. Thomas: Faunal Assemblage of Balathal.

P.P. Joglekar: Faunal Remains from Apegaon, District Aurangabad, Maharashtra.

Sila Tripati: Marine Archaeological Investigations in Indian and Portugal Waters: Implications for Trade and Cultural Exchanges as deduced from Shipwrecks.

Sushma Deo G., Sheila Mishra and S. N. Rajaguru: Early Acheulian at Morgaon, District Pune, Maharashtra.

Savita N. Ghate, Sheila Mishra and S.N. Rajaguru: Geoarchaeology of Gunore.

Sheila Mishra, Sonali Naik and S.B. Ota: Upper Palaeolithic Sites in the Narmada Valley.

R.K. Ganjoo: Glacial Retreat in the Pleistocene — A Case study from Kinnaur District, Himachal Pradesh.

Vibha Tripathi: The Myth of Sarasvati at Prayag: Evidence from Remote Sensing.

P. Vijaya Prakash: Megalithic Structural Variation and the Significance of Mortuary Practices: A Study on the Tribal Tri-junction of Papi, Bailadila and Malkangiri Hill Tracts.

V.H. Sonawane, K.K. Bhan, S. Pratapchandran, K. Krishnan, P. Ajithprasad and Abhijit Majumdar: Excavation at Bagasra 1999-2000: A Preliminary Report.

Arati Deshpande-Mukherjee: Contemporary Shellfish Gathering on the Konkan Coast, Maharashtra.

D.N. Tripathi: Purush-Stelae from Bagnolo (Italy) and the Rigveda;

Indo-European Homeland: the Indian Perspective.

A.S. Gaur, Sunderesh, Sila Tripathi and K.H. Vora: Marine Archaeological Investigations in Okhamandal Region.

Ajoy Kumar Sinha: Further Excavation at Buxar.

Rohita Eswar: An Insight into the Works of "Mallitamma" at Somanathpura Keshava Temple.

P.M. Saklani, B.M. Khanduri and Praveen Joshi: Cult of Nanda in the Central Himalaya: An Ethnographic Approach.

K.S. Shukla: The Earlisest Indian Civilization through its Seals and Sealings.

V.N. Misra and R.K. Mohanty: Further Excavations at Balathal, Dist. Udaipur, Rajasthan (1999-2000).

Devi Prasad Tewari: Excavation at Charda, District Bahraich, U.P.

P. Binodini Devi: Manipur Megaliths.

M.D. Kajale: On the Antiquity of Safflower (*Carthamus tinctorius* Linn.) from India.

Richa Jhaldiyal: Interpreting Formation Processes of the Archaeological Record through Experimental Studies.

S.K. Aruni: Interpreting the Plan of Surapura: A Post-Vijayanagara Capital Seat in the Deccan.

M.C. Gupta, V.D. Misra and J.N. Pal: Excavation at Tokwa — 2000.

H.N. Dutta: Archaeological Importance of Doiyang-Dhansiri Valley of Assam.

Giriraj Kumar: Chronology of Indian Rock Art: A Fresh Attempt.

Rajaram Hegde: The Early Medieval Tiles from Karnataka.

Ravi Korisettar: Recent Advances in South Indian Neolithic.

Y.S. Farswan: Importance of Estimation of Trace Elements in the Bones of Modern Goat in Relation to Various Types of Induced Diet.

Arakhita Pradhan: A Study of the Rock Engravings of Deulgaon Hills in Rairakhol Tehsil, Orissa.

Sunil Gupta: Southeast Asia in the Indo-Pacific Sphere: 3000 B.C.–300 A.D.

New Life Members

The following persons joined the family of life members of the Society:

A.A. Ashraf, Bishnupriya Basak, Atul Kumar Bhargava, Hemant Dave, Dorian Fuller, B.S. Gajul, R. Harini, N. Havalaiah, R.R. Hegde, Shahanaj Husne Jahan Leena, Smita Marathe, S. Abdul Munaf, V.N. Prabhakar, Sidharth Sankarpadhi, P.C. Sharma, Saurabha Sharma, Sundaresh, Sushri M. Vikram, Prabhakar Uapdhyaya

Meeting of the Executive Committee

Minutes of the Meeting of the Executive Committee

A meeting of the Executive Committee of the Society was held in the Committee Room of the National Museum, New Delhi on Sunday, 3rd December 2000. The following members were present

01. Prof. V. D. Misra (in chair)
02. Dr. R. D. Chaudhury
03. Prof. V. N. Misra
04. Dr. P. K. Thomas
05. Dr. R. K. Mohanty
06. Dr. P. P. Joglekar
07. Dr. B. L. Nagarch
08. Dr. P. S. Joshi
09. Dr. Sheila Misra
10. Dr. Vijay Sathe
11. Dr. Malti Nagar
12. Dr. B. C. Deotare
13. Dr. Savita Ghate

Prof. R.K. Sharma, a life member of the Society and former Professor and Head of the Department of Ancient Indian History, Culture and Archaeology, Rani Durgavati Viswavidyalaya, Jabalpur attended the meeting as a special invitee.

Dr. P.P. Dandawate, Dr. K. Krishnan, Dr. K.P. Rao, Dr. J.N. Pande, Dr. Ravi Korisetter, Dr. P. V. Pathak and Dr. S.F. Wadia were unable to attend the meeting.

The following business was transacted at the Meeting:

At the outset, the General Secretary, Prof. V.N. Misra welcomed the members. He expressed his happiness that at this meeting the Chairman, Prof. V.D. Misra and the Vice-chairman Dr. R.D. Choudhury were both present. Since, normally the meetings of the Executive Committee are held at the Society's office in Pune, members based outside Pune, are unable to attend them.

1. The General Secretary appraised the Committee about the major activities of the Society during 1999-2000. These include the details of the 27th Annual Conference held at the Deccan College. Pune on 26th–30th December 1999, and publication of Vol. XXV(1) of *Man and Environment.* He also apprised the Committee of the details of the audited statement of Society's income and expenditure during 1999-2000. This statement will be printed in Man and Environment Vol. XXV(2). The Society's financial situation remains reasonably good.
2. The General Secretary proposed the names of Prof. M.K. Dhavalikar, former Director, Deccan College, Pune and Prof. K. Thimma Reddy, former Professor of Prehistoric Archaeology, Andhra University, Waltair for the positions of H.D. Sankalia Memorial Lecture and President of the Society for 2001. The nameswere unanimously approved by the Committee.
3. The General secretary proposed that Dr. Ravi Korisetter, Dr. P.P. Joglekar and Dr. Sheila Misra who have been working as Associate Editors of *Man and Environment* for the last several years be designated as Joint Editors. The proposal was unanimously approved by the Committee. The

General Secretary further proposed to invite Dr. B.C. Deotare and Dr. Savita N. Ghate to join the Editorial Board of the Man and Environment as Assistant Editors. The Proposal was unanimously approved by the Committee.

4. The General Secretary informed the Committee that Dr. R.K. Mohanty, Assistant Secretary is proceeding to London in early January 2001 to take up a Visiting Fellowship at the Institute of Archaeology. Since, Dr. Mohanty is in charge of the distribution of the Journal to Society's life members as well as to booksellers, arrangements have to be made for shouldering this responsibility during Dr. Mohanty's absence. The General Secretary proposed the name of Dr. P.S. Joshi for the post of Assistant Secretary. This was unanimously approved by the Committee.

5. Several years ago Prof. R.K. Sharma, then Professor and Head of the Department of Ancient Indian History, Culture and Archaeology, Rani Durgawati Viswavidyalaya, Jabalpur had offered a donation of Rs. 100,000.00 to the Society for instituting an award in his name to be given every two or three years to an eminent archaeologist. Regarding the terms and conditions of the award there was considerable correspondence between the General Secretary, Prof. V.N. Misra and Prof. R.K. Sharma. The matter was also discussed at several meetings of the Executive Committee of the Society. The last discussions were at the meeting of the Executive Committee held on 14th March 1997 at which the Committee discussed the draft agreement between the Society and Prof. Sharma and proposed certain modifications in the draft. These were set out in the General Secretary's report for 1996-97 and printed on page 115-116 of Vol. XXII(1) of the Journal. The modifications proposed by the Executive Committee were communicated by the General Secretary to Prof. Sharma and they were approved by him. The agreement was approved by the General Body of the Society at its meeting held at H.N. Bahuguna Garhwal University, Srinagar on 16th October 1997. Accordingly, the agreement on stamp paper was signed by Prof. R.K. Sharma on his own behalf and Prof. V.N. Misra, General Secretary of the Society on behalf of the Society. The donation to be given by Prof. Sharma was in the form of bonds, which will mature in December 2000. After the bonds mature, Prof. Sharma would transfer the matured amount by Bank Draft to the Society.

   Initially, it was decided that keeping in view the limited number of outstanding archaeologists available, the award should be given every three years and the first award will be given three years after the donation amount is made available to the Society so that enough funds would have accrued by way of interest. At the present meeting Prof. Sharma informed that the bonds would mature in December 2000 or early in January 2001. Prof. Sharma also suggested that the first award should be given in 2001 itself and he would give an additional donation of Rs. 11,000.00 to the Society for this purpose. The Committee accepted Prof. Sharma' additional donation Rs. 11,000.00 with thanks. The agreement between Prof. R.K. Sharma and the Society as also terms and conditions of the award will be printed in the next issue of the *Man and Environment.*

   The General Secretary suggested that since majority of the members of the Executive Committee, and in particular Prof. R.K. Sharma himself are present at the meeting, it would be appropriate to select the first Awardee at this meeting itself. The General Secretary proposed the name of Shri Krishna Deva, the senior most and universally respected archaeologist for the first Award. The proposal was unanimously approved by the Committee. It was further decided that the first Award be given at the next Annual Conference of the Society to be held at the M.S. University, Vadodara.

The meeting ended with a vote of thanks to the chair.

20.12.2001

(V.N. Misra)
General Secretary

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Contents

1. **Archaeology of the Eastern Ghats: an Ecological Overview**
K. Thimma Reddy 1

2. **Green Imperialism: Monsoon in Antiquity and Human Response**
M.K. Dhavalikar 17

3. **Role of Surface Sites in Indian Palaeolithic Research: a Case Study from the Hunsgi and Baichbal Valleys, Karnataka**
K. Paddayya and Richa Jhaldiyal

4. **Holocene Episodes of Colluvial Deposition at Kalapet near Pondicherry**
Hema Achyuthan, Savita Ghate, Sushma G. Deo and Sheila Mishra

5. **Archaeological Re-investigation and Archaeozoology of Seven Southern Neolithic Sites in Karnataka and Andhra Pradesh**
Ravi Korisettar, P.P. Joglekar, Dorian Q. Fuller and P.C. Venkatasubbaiah 4

6. **A Rare Chalcolithic Pottery Cache from Balathal, Rajasthan**
V.N. Misra and R.K. Mohanty 67

7. **Ochre Coloured Pottery: Its Genetic Relationship with Harappan Ware**
M.D.N. Sahi 75

8. **Some Metallurgical Aspects of an OCP Period Copper Hoard**
R. Balasubramaniam, M.N. Mungole, V.N. Prabhakar, D.V. Sharma and D. Banerjee 8

9. **Glass Beads in India: Lamp Winding and Moulding Techniques**
Alok Kumar Kanungo

10. **A Rare Discovery of Metal Objects from Agiabir, District Mirzapur, Uttar Pradesh**
Purushottam Singh and Ashok Kumar Singh

11. **Addenda to The Copper Hoards of the Indian Subcontinent: Preliminaries for an Interpretation**
Paul Yule 1

12. **Book Reviews** 1
Sheila Mishra, V.N. Misra, R.K. Mohanty

13. **Obituary**

14. **Report of the General Secretary**